SEQUENCE LISTING

```
<110> NORPHARMA SPA
<120> Recombinant bacterial strains for the production of
     natural nucleosides and modified analogues thereof
<130> 99DC26E
<140> PCT/EP99/10416
<141> 1999-12-23
<150> MI98A002792
<151> 1998-12-23
<160> 15
<170> PatentIn Ver. 2.1
<210> 1
<211> 3444
<212> DNA
<213> Artificial Sequence
<220>
<223> Description of Artificial Sequence: Plasmid
<220>
<221> gene
<222> (243)..(1021)
<223> udp
<400> 1
gegeccaata egeaaacege eteteceege gegttggeeg atteattaat geagetggea 60
cgacaggttt cccgactgga aagcgggcag tgagcgcaac gcaattaatg tgagttagct 120
cactcattag gcaccccagg ctttacactt tatgcttccg gctcgtatgt tgtgtggaat 180
tgtgagcgga taacaatttc acacaggaaa cagctatgac catgattacg aattcgagct 240
eggtaccate catgtecaag tetgatgttt tteatetegg eeteactaaa aacgatttae 300
aaggggctac gettgecate gteectggeg acceggateg tgtggaaaag ategeegege 360
tgatggataa gccggttaag ctggcatctc accgcgaatt cactacctgg cgtgcagagc 420
tggatggtaa acctgttatc gtctgctcta ccggtatcgg cggcccgtct acctctattg 480
ctgttgaaga getggeacag etgggeatte geacetteet/gegtateggt acaaegggeg 540
ctattcagcc gcatattaat gtgggtgatg tcctggttac cacggcgtct gtccgtctgg 600
atggcgcgag cotgcactto gcaccgctgg aattoccggc tgtcgctgat ttcgaatgta 660
cgactgcgct ggttgaagct gcgaaatcca ttggcgcgac aactcacgtt ggcgtgacag 720
cttottotga tacottotac ocaggicagg aacgitacga tacttactot ggicgogiag 780
ttogtcactt taaaggitet atggaagagt ggeaggegat gggegtaatg aactatgaaa 840
```

tggaatetge aaccetgotg accatgtgtg caagtcaggg cotgogtgeo ggtatggtag 900

cgggtgttat cgttaaccgc acccagcaag agatcccgaa tgctgagacg atgaaacaaa 960 ccgaaagcca tgcggtgaaa atcgtggtgg aagcggcgcg tcgtctgctg taattctctt 1020 qtcgacctgc aggcatgcaa gcttggcact ggccgtcgtt ttacaacgtc gtgactggga 1080 aaaccetgge gttacceaac ttaategeet tgcagcacat ceceettteg ccagetggeg 1140 taatagegaa gaggeeegea eegategeee tteeeaacag ttgegeagee tgaatggega 1200 atggcgcctg atgcggtatt ttctccttac gcatctgtgc ggtatttcac accgcatatg 1260 gtgcactete agtacaatet getetgatge egeatagtta agecageece gacaceegee 1320 aacacccgct gacgcgccct gacgggcttg tctgctcccg gcatccgctt acagacaagc 1380 tgtgaccgtc tccgggagct gcatgtgtca gaggttttca ccgtcatcac cgaaacgcgc 1440 gagacgaaag ggcctcgtga tacgcctatt tttataggtt aatgtcatga taataatggt 1500 ttottagacq tcaqqtqqca cttttcqqqq aaatqtqcqc qqaaccccta tttqtttatt 1560 tttctaaata cattcaaata tgtatccgct catgagacaa taaccctgat aaatgcttca 1620 ataatattga aaaaggaaga gtatgagtat tcaacatttc cgtgtcgccc ttattccctt 1680 ttttgcggca ttttgccttc ctgtttttgc tcacccagaa acgctggtga aagtaaaaga 1740 tgctgaagat cagttgggtg cacgagtggg ttacatcgaa ctggatctca acagcggtaa 1800 gateettgag agttttegee eegaagaaeg tttteeaatg atgageaett ttaaagttet 1860 gctatgtggc gcggtattat cocgtattga cgccgggcaa gagcaacteg gtcgccgcat 1920 acactattct cagaatgact tggttgagta ctcaccagtc acagaaaagc atcttacgga 1980 tggcatgaca gtaagagaat tatgcagtgc tgccataacc atgagtgata acactgcggc 2040 caacttactt ctgacaacga tcggaggacc gaaggagcta accqcttttt tgcacaacat 2100 gggggatcat gtaactcgcc ttgatcgttg ggaaccggag ctgaatgaag ccataccaaa 2160 cgacgagcgt gacaccacga tgcctgtagc aatggcaaca acgttgcgca aactattaac 2220 tggcgaacta ettactetag etteceggea acaattaata gaetggatgg aggeggataa 2280 agttgcagga ccacttctgc gctcggccct tccggctggc tggtttattg ctgataaatc 2340 tggagccggt gagcgtgggt ctcgcggtat cattgcagca ctggggccag atggtaagcc 2400 ctcccgtatc gtagttatct acacgacggg gagtcaggca actatggatg aacgaaatag 2460 acagateget gagataggtg ceteaetgat taageattgg taactgteag accaagttta 2520 ctcatatata ctttagattg atttaaaact tcatttttaa tttaaaagga tctaggtgaa 2580 gatectittt gataatetea tgaecaaaat eeettaaegt gagttitegt teeactgage 2640 gtcagacccc gtagaaaaga tcaaaggatc ttcttgagat cctttttttc tgcgcgtaat 2700 ctgctgcttg caaacaaaaa aaccaccgct accagcggtg gtttgtttgc cggatcaaga 2760 gctaccaact ctttttccga aggtaactgg cttcagcaga gcgcagatac caaatactgt 2820 cettetagtg tagecgtagt taggecacca etteaagaae tetgtageae egeetaeata 2880 cetegetetg etaateetgt taccagtgge tgetgeeagt ggegataagt egtgtettae 2940 egggttggae teaagaegat agttaeegga taaggegeag eggteggget gaaegggggg 3000 ttcgtgcaca cagcccaget tggagcgaac gacctacacc gaactgagat acctacagcg 3060 tgagctatga gaaagcgcca cgcttcccga agggagaaag gcggacaggt atccggtaag 3120 eggeagggte ggaacaggag agegeacgag ggagetteca gggggaaaeg eetggtatet 3180 ttatagtcct gtcgggtttc gccacctctg acttgagcgt cgatttttgt gatgctcgtc 3240 aggggggggg agcctatgga aaaacgccag caacgcggcc tttttacggt tcctggcctt 3300 ttgctggcct tttgctcaca tgttctttcc tgcgttatcc cctgattctg tggataaccg 3360 tattacegee tttgagtgag etgatacege tegeegeage egaaegaeeg agegeagega 3420 gtcagtgagc gaggaagcgg aaga 3444

<210> 2 <211> 5556

<212> DNA

<213> Artificial Sequence <220> <223> Description of Artificial Sequence: Plasmid <220> <221> gene <222> (243)..(1021) <223> udp <220> <221> gene <222> (1483)..(2883) <223> tetracycline resistance <400> 2 gegeceaata egeaaacege eteteecege gegttggeeg atteattaat geagetggea 60 cgacaggttt cccgactgga aagcgggcag tgagcgcaac gcaattaatg tgagttagct 120 cactcattag gcaccccagg ctttacactt tatgcttccg gctcgtatgt tgtgtggaat 180 tgtgagcgga taacaatttc acacaggaaa cagctatgac catgattacg aattcgagct 240 eggtaceate catgiceaag tetgatgitt ticatetegg eetcactaaa aacgatitae 300 aaggggetac gettgecate gteeetggeg acceggateg tgtggaaaag ategeegege 360 tgatggataa gccggttaag ctggcatctc accgcgaatt cactacctqq cqtgcagagc 420 tggatggtaa acctgttatc gtctgctcta ceggtategg eggecegtct acctctattg 480 ctgttgaaga gctggcacag ctgggcattc gcaccttcct gcgtatcggt acaacgggcg 540 ctattcagcc gcatattaat gtgggtgatg tcctggttac cacggcgtct gtccgtctgg 600 atggcgcgag cctgcacttc gcaccgctgg aattcccggc tgtcgctgat ttcgaatgta 660 cgactgcgct ggttgaagct gcgaaatcca ttggcgcgac aactcacgtt ggcgtgacag 720 cttcttctga taccttctac ccaggtcagg aacgttacga tacttactct ggtcgcgtag 780 ttcgtcactt taaaggttct atggaagagt ggcaggcgat gggcgtaatg aactatgaaa 840 tggaatctgc aaccctgctg accatgtgtg caagtcaggg cctgcgtgcc ggtatggtag 900 cgggtgttat cgttaaccgc acccagcaag agatcccgaa tgctgagacg atgaaacaaa 960 ccgaaagcca tgcggtgaaa atcgtggtgg aagcggcgcg tcgtctgctg taattctctt 1020 gtcgacctgc aggcatgcaa gctttatgct tgtaaaccgt tttgtgaaaa aatttttaaa 1080 ataaaaaagg ggacctctag ggtccccaat taattagtaa tataatctat taaaggtcat 1140 tcaaaaggtc atccaccgga tcagcttagt aaagccctcg ctagatttta atgcggatgt 1200 tgcgattact tcgccaacta ttgcgataac aagaaaaagc cagcctttca tgatatatct 1260 cccaatttgt gtagggctta ttatgcacgc ttaaaaaataa taaaagcaga cttgacctga 1320 tagtttggct gtgagcaatt atgtgcttag tgcatctaac gcttgagtta agccgcgccg 1380 cgaagcggcg tcggcttgaa cgaattgtta gacattattt gccgactacc ttggtgatct 1440 cgcctttcac gtagtggaca aattetteca actgatetge gegeegagat gegeegegtg 1500 eggetgetgg agatggegga egegatggat atgttetgee aagggttggt ttgegeatte 1560 acagttotoc gcaagaattg attggctoca attottggag tggtgaatcc gttagcgagg 1620 tgccgccggc ttccattcag gtcgaggtgg cccggctcca tgcaccgcga cgcaacgcgg 1680 ggaggcagac aaggtatagg gcggcgccta caatccatgc caacccgttc catgtgctcg 1740 cogaggegge ataaategee gtgacgatea geggteeagt gategaagtt aggetggtaa 1800 gageogegag egateettga agetgteeet gatggtegte atetacetge etggacagea 1860

tggcctgcaa cgcgggcatc ccgatgccgc cggaagcgag aagaatcata atggggaagg 1920

ccatccages tegegtegeg aacgecagea agacgtages cagegegteg geogecatge 1980 eggegataat ggeetgette tegeegaaae gtttggtgge gggaceagtg acgaaggett 2040 gagcgaggge gtgcaagatt ccgaataccg caagcgacag gccgatcatc gtcgcgctcc 2100 agegaaageg gteetegeeg aaaatgaeee agagegetge eggeaeetgt eetaegagtt 2160 gcatgataaa gaagacagte ataagtgegg egaegatagt catgeeeege geeeaeegga 2220 aggagetgae tgggttgaag geteteaagg geateggteg aegeteteee ttatgegaet 2280 cctgcattag gaagcagccc agtagtaggt tgaggccgtt gagcaccgcc gccgcaagga 2340 atggtgcatg caaggagatg gcgcccaaca gtcccccggc cacggggcct gccaccatac 2400 ccacgeegaa acaagegete atgageeega agtggegage eegatettee ecateggtga 2460 tgtcggcgat ataggcgcca gcaaccgcac ctgtggcgcc ggtgatgccg gccacgatgc 2520 gtccggcgta gaggatccac aggacgggtg tggtcgccat gatcgcgtag tcgatagtgg 2580 ctccaagtag cgaagcgagc aggactgggc ggcggccaaa gcggtcggac agtgctccga 2640 gaacgggtgc gcatagaaat tgcatcaacg catatagcgc tagcagcacg ccatagtgac 2700 tggcgatgct gtcggaatgg acgatatccc gcaagaggcc cggcagtacc ggcataacca 2760 agectatgee tacageatee agggtgaegg tgeegaggat gaegatgage geattgttag 2820 atttcataca cggtgcctga ctgcgttagc aatttaactg tgataaacta ccgcattaaa 2880 gctcatgcgg atcagtgagg gtttgcaact gcgggtcaag gatctggatt tcgatcacgg 2940 cacgateate gtgegggagg geaagggete caaggategg geettgatgt taccegagag 3000 cttggcaccc agcctgcgcg agcaggggaa ttgatccggt ggatgacctt ttgaatgacc 3060 tttaatagat tatattacta attaattggg gaccctagag gtcccctttt ttattttaaa 3120 aattttttca caaaacggtt tacaagcata aagcttggca ctggccgtcg ttttacaacg 3180 tegtgactgg gaaaaccetg gegttaccea acttaatege ettgeageae atececettt 3240 egecagetgg egtaatageg aagaggeeeg cacegatege eetteecaae agttgegeag 3300 cctgaatggc gaatggcgcc tgatgcggta ttttctcctt acgcatctgt gcggtatttc 3360 acaccgcata tggtgcactc tcagtacaat ctgctctgat gccgcatagt taagccagcc 3420 ccgacacccg ccaacacccg ctgacgcgcc ctgacgggct tgtctgctcc cggcatccgc 3480 ttacagacaa getgtgaceg teteegggag etgeatgtgt cagaggtttt caeegteate 3540 accgaaacgc gcgagacgaa agggcctcgt gatacgccta tttttatagg ttaatgtcat 3600 gataataatg gtttcttaga cgtcaggtgg cacttttcgg ggaaatgtgc gcggaacccc 3660 tatttgttta tttttctaaa tacattcaaa tatgtatccg ctcatgagac aataaccctg 3720 ataaatgott caataatatt gaaaaaggaa gagtatgagt attcaacatt teegtgtege 3780 cettattece ttttttgegg cattttgeet teetgttttt geteaceeag aaaegetggt 3840 gaaagtaaaa gatgctgaag atcagttggg tgcacgagtg ggttacatcg aactggatct 3900 caacageggt aagateettg agagtttteg eecegaagaa egtttteeaa tgatgageae 3960 ttttaaagtt ctgctatgtg gegeggtatt atceegtatt gaegeeggge aagageaact 4020 cggtcgccgc atacactatt ctcagaatga cttggttgag tactcaccag tcacagaaaa 4080 gcatcttacg gatggcatga cagtaagaga attatgcagt gctgccataa ccatgagtga 4140 taacactgcg gecaacttac ttetgacaac gateggagga eegaaggage taacegettt 4200 tttgcacaac atgggggatc atgtaactcg ccttgatcgt tgggaaccgg agctgaatga 4260 agccatacca aacgacgage gtgacaccae gatgcetgta geaatggcaa caacgttgeg 4320 caaactatta actggcgaac tacttactct agcttcccgg caacaattaa tagactggat 4380 ggaggcggat aaagttgcag gaccacttct gcgctcggcc cttccggctg gctggtttat 4440 tgctgataaa tetggageeg gtgagegtgg gtetegeggt ateattgeag caetggggee 4500 agatggtaag ceeteeegta tegtagttat etacaegaeg gggagteagg caactatgga 4560 tgaacgaaat agacagateg etgagatagg tgeeteactg attaageatt ggtaactgte 4620 agaccaagtt tactcatata tactttagat tgatttaaaa cttcattttt aatttaaaag 4680 gatotaggtg aagatoottt ttgataatot catgaccaaa atooottaac gtgagttttc 4740 gttecaetga gegteagaee eegtagaaaa gateaaagga tettettgag ateetttttt 4800

tetgegegta atetgetget tgeaaacaaa aaaaccaceg etaccagegg tggtttgttt 4860 geeggateaa gagetaceaa etettttee gaaggtaact ggetteagea gagegeagat 4920 accaaatact gteettetag tgtageegta gttaggeeae eaetteaaga actetgtage 4980 accgeetaca tacetegete tgetaateet gttaccagtg getgetgeea gtggegataa 5040 gtegtgetet accgggttgg acteaagaeg atagttaceg gataaggege ageggteggg 5100 etgaaegggg ggttegtgea eaeageeeag ettggagega acgaeetaea eegaaetgag 5160 atacetacag egtgagetat gagaaagege eaegetteee gaagggagaa aggeggaeag 5220 gtateeggta etttatagte etgetgggt tegeeacete tgaeetgage gtegatett 5340 gtgatgeteg teaggggge ggageetatg gaaaaaegee ageaaegggg eettttaeg 5400 gtteetggee tettgegeg ettttgetea eatgttett eetgegttat eeeetgatte 5460 tgtggataac egtattaeeg eetttgagtg agetgataee geegaaega 5520 egagegeage gagteagtga gegaggaage ggaaga

<210> 3
<211> 3383
<212> DNA
<213> Artificial Sequence
<220>
<223> Description of Artificial Sequence: Plasmid
<220>
<221> gene
<222> (231)..(960)
<223> deoD
<400> 3

gegeecaata egeaaacege eteteecege gegttggeeg atteattaat geagetggea 60 cqacaggttt cccgactgga aagcgggcag tgagcgcaac gcaattaatg tgagttagct 120 cactcattag gcaccccagg ctttacactt tatgcttccg gctcgtatgt tgtgtggaat 180 tgtgagegga taacaattte acaeaggaaa eagetatgae eatgattaeg aattetteea 240 tygctacccc acacattaat gcagaaatgg gcgatttcgc tgacgtagtt ttgatgccag 300 gcgacccgct gcgtgcgaag tatattgctg aaactttcct tgaagatgcc cgtgaagtga 360 acaacgttcg cggtatgctg ggcttcaccg gtacttacaa aggccgcaaa atttccgtaa 420 tyggtcacg; tatgggtatc ccgtcctgct ccatctacac caaagaactg atcaccgatt 480 teggegtgaa gaaaattate egegtgggtt eetgtggege agttetgeeg caegtaaaac 540 tgegegaegt egttateggt atgggtgeet geaeegatte caaagttaae egcateegtt 600 ttaaagacca tgactttgcc gctatcgctg acttcgacat ggtgcgtaac gcagtagatg 660 cagetaaage actgggtatt gatgetegeg tgggtaacet gtteteeget gaeetgttet 720 actologga oggogaaatg ttogaogtga tggaaaaata oggoattoto ggogtggaaa 780 tggaagegge tggtatetae ggegtegetg cagaatttgg egegaaagee etgaeeatet 840 gdaccgtats tgaccacato ogdacteacg agcagaceac tgdogctgag ogtcagacta 900 cottcoacga catgatcaaa atcgcactgg aatccgttct gotgggcgat aaagagtaag 960 togacotgoa ggoatgoaag ottggoactg googtogttt tacaacgtog tgactgggaa 1020 ascortggog tracocaact taatogoott gbagcacato obestttege cagetggogt 1080 aatagogaag aggooogoac ogatogooot toocaacagt tgogoagoot gaatggogaa 1140 tggcgcctga tgcggtattt tctccttacg catctgtgcg gtatttcaca ccgcatatgg 1200 tgcactetea gtacaatetg etetgatgee geatagttaa geeageeeeg acaceegeea 1260 acaccegety acgegecety acgggettyt etgetecegy cateegetta cagacaaget 1320 gtgaccgtct ccgggagctg catgtgtcag aggttttcac cgtcatcacc gaaacgcgcg 1380 agacgaaagg geetegtgat aegeetattt ttataggtta atgteatgat aataatggtt 1440 tettagaegt eaggtggeae ttttegggga aatgtgegeg gaaeceetat ttgtttattt 1500 ttctaaatac attcaaatat gtatccgctc atgagacaat aaccctgata aatgcttcaa 1560 taatattgaa aaaggaagag tatgagtatt caacatttcc gtgtcgccct tattcccttt 1620 tttgcggcat tttgccttcc tgtttttgct cacccagaaa cgctggtgaa agtaaaagat 1680 gctgaagatc agttgggtgc acgagtgggt tacatcgaac tggatctcaa cagcggtaag 1740 atccttgaga gttttcgccc cgaagaacgt tttccaatga tgagcacttt taaagttctg 1800 ctatgtggcg cggtattatc ccgtattgac gccgggcaag agcaactcgg tcgccgcata 1860 cactattete agaatgaett ggttgagtae teaceagtea eagaaaagea tettaeggat 1920 ggcatgacag taagagaatt atgcagtgct gccataacca tgagtgataa cactgcggcc 1980 aacttacttc tgacaacgat cggaggaccg aaggagctaa ccgctttttt gcacaacatg 2040 ggggatcatg taactcgcct tgatcgttgg gaaccggagc tgaatgaagc cataccaaac 2100 gacgagcgtg acaccacgat gcctgtagca atggcaacaa cgttgcgcaa actattaact 2160 ggcgaactac ttactctagc ttcccggcaa caattaatag actggatgga ggcggataaa 2220 gttgcaggac cacttctgcg ctcggccctt ccggctggct ggtttattgc tgataaatct 2280 ggagceggtg agegtgggte tegeggtate attgcageae tggggceaga tggtaageee 2340 tecegtateg tagttateta caegaegggg agteaggeaa etatggatga aegaaataga 2400 cagategetg agataggtge etcactgatt aageattggt aactgteaga ecaagtttae 2460 tcatatatac tttagattga tttaaaactt catttttaat ttaaaaggat ctaggtgaag 2520 atcetttttg ataateteat gaccaaaate cettaaegtg agttttegtt ceaetgageg 2580 tcagaccccg tagaaaagat caaaggatct tcttgagatc ctttttttct gcgcgtaatc 2640 tgctgcttgc aaacaaaaa accaccgcta ccagcggtgg tttgtttgcc ggatcaagag 2700 ctaccaactc tttttccgaa ggtaactggc ttcagcagag cgcagatacc aaatactgtc 2760 cttctagtgt agccgtagtt aggccaccac ttcaagaact ctgtagcacc gcctacatac 2820 ctcgctctgc taatcctgtt accagtggct gctgccagtg gcgataagtc gtgtcttacc 2880 gggttggact caagacgata gttaccggat aaggcgcagc ggtcgggctg aacggggggt 2940 tegtgeacae ageceagett ggagegaaeg acetacaeeg aactgagata cetacagegt 3000 gagctatgag aaagcgccac gcttcccgaa gggagaaagg cggacaggta tccggtaagc 3060 ggcagggtcg gaacaggaga gcgcacgagg gagcttccag ggggaaacgc ctggtatctt 3120 tatagtectg tegggttteg ceacetetga ettgagegte gatttttgtg atgetegtea 3180 ggggggcgga gcctatggaa aaacgccagc aacgcggcct ttttacggtt cctggccttt 3240 tgctggcctt ttgctcacat gttctttcct gcgttatccc ctgattctgt ggataaccgt 3300 attaccgcct ttgagtgagc tgataccgct cgccgcagcc gaacgaccga gcgcagcgag 3360 3383 tcagtgagcg aggaagcgga aga

```
<210> 4
<211> 5495
<212> DNA
<213> Artificial Sequence
```

<220>

<223> Description of Artificial Sequence: Plasmid

<220>
<221> gene
<222> (231)..(960)
<223> deoD

<220>
<221> gene
<222> (1423)..(2822)
<223> tetracycline resistance

<400> 4

gegeecaata egeaaacege eteteecege gegttggeeg atteattaat geagetggea 60 cgacaggttt cccgactgga aagcgggcag tgagcgcaac gcaattaatg tgagttagct 120 cactcattag gcaccccagg ctttacactt tatgcttccg gctcgtatgt tgtgtggaat 180 tgtgagcgga taacaatttc acacaggaaa cagctatgac catgattacg aattcttcca 240 tggctacccc acacattaat gcagaaatgg gcgatttcgc tgacgtagtt ttgatgccag 300 gcgacccgct gcgtgcgaag tatattgctg aaactttcct tgaagatgcc cgtgaagtga 360 acaacgttcg cggtatgctg ggcttcaccg gtacttacaa aggccgcaaa atttccgtaa 420 tgggtcacgg tatgggtate cegteetget ceatetacae caaagaactg atcacegatt 480 teggegtgaa gaaaattate egegtgggtt eetgtggege agttetgeeg eaegtaaaae 540 tgcgcgacgt cgttatcggt atgggtgcct gcaccgattc caaagttaac cgcatccgtt 600 ttaaagacca tgactttgcc gctatcgctg acttcgacat ggtgcgtaac gcagtagatg 660 cagetaaage actgggtatt gatgetegeg tgggtaacet gtteteeget gacetgttet 720 actotocgga oggogaaatg ttogacgtga tggaaaaata oggoattoto ggogtggaaa 780 tggaagcggc tggtatctac ggcgtcgctg cagaatttgg cgcgaaagcc ctgaccatct 840 gcaccgtate tgaccacate egcacteacg ageagaceae tgeegetgag egteagacta 900 ccttcaacga catgatcaaa atcgcactgg aatccgttct gctgggcgat aaagagtaag 960 tcgacctgca ggcatgcaag ctttatgctt gtaaaccgtt ttgtgaaaaa atttttaaaa 1020 taaaaaaggg gacctctagg gtccccaatt aattagtaat ataatctatt aaaggtcatt 1080 caaaaggtca tccaccggat cagcttagta aagccctcgc tagattttaa tgcggatgtt 1140 gegattaett egecaactat tgegataaca agaaaaagee ageettteat gatatatete 1200 ccaatttgtg tagggcttat tatgcacgct taaaaataat aaaagcagac ttgacctgat 1260 gaageggegt eggettgaae gaattgttag acattatttg eegactaeet tggtgatete 1380 geettteacg tagtggacaa attetteeaa etgatetgeg egeegagatg egeegegtge 1440 ggctgctgga gatggcggac gcgatggata tgttctgcca agggttggtt tgcgcattca 1500 cagttctccg caagaattga ttggctccaa ttcttggagt ggtgaatccg ttagcgaggt 1560 geogeogget tecatteagg tegaggtgge eeggeteeat geacegegae geaacgeggg 1620 gaggcagaca aggtataggg eggegeetae aatecatgee aaceegttee atgtgetege 1680 cgaggcggca taaatcgccg tgacgatcag cggtccagtg atcgaagtta ggctggtaag 1740 ageogogage gateettgaa getgteeetg atggtegtea tetacetgee tggacageat 1800 ggcctgcaac gegggcatec egatgcegee ggaagegaga agaateataa tggggaagge 1860 catecageet egegtegega acgecageaa gaegtageee agegegtegg eegecatgee 1920 ggegataatg geetgettet egeegaaaeg tttggtggeg ggaceagtga egaaggettg 1980 agcgagggcg tgcaagattc cgaataccgc aagcgacagg ccgatcatcg tcgcgctcca 2040 gegaaagegg testegeega aaatgaceea gagegetgee ggeacetgte ctaegagttg 2100 $\verb|catgata| \verb|aagaca| \verb|gtca| | taagtgcggc| gacgatagtc| atgccccgcg| cccaccggaa| 2160$ ggagetgaet gggttgaagg eteteaaggg eateggtega egeteteeet tatgegaete 2220 ctgcattagg aagcagcca gtagtaggtt gaggccgttg agcaccgccg ccgcaaggaa 2280 tggtgcatgc aaggagatgg cgcccaacag tcccccggcc acggggcctg ccaccatacc 2340 cacgeegaaa caagegetea tgageeegaa gtggegagee egatetteee eateggtgat 2400 gtoggogata taggogocag caacogoaco tgtggogoog gtgatgoogg coacgatgog 2460 teeggegtag aggateeaea ggaegggtgt ggtegeeatg ategegtagt egatagtgge 2520 tccaagtage gaagegagea ggaetgggeg geggeeaaag eggteggaea gtgeteegag 2580 aacgggtgcg catagaaatt gcatcaacgc atatagcgct agcagcacgc catagtgact 2640 ggcgatgctg tcggaatgga cgatatcccg caagaggccc ggcagtaccg gcataaccaa 2700 qcctatgcct acagcatcca gggtgacggt gccgaggatg acgatgagcg cattgttaga 2760 tttcatacac ggtgcctgac tgcgttagca atttaactgt gataaactac cgcattaaag 2820 ctcatgcgga tcagtgaggg tttgcaactg cgggtcaagg atctggattt cgatcacggc 2880 acgatcateg tgegggaggg caagggetee aaggateggg cettgatgtt accegagage 2940 ttqqcaccca qcctqcqcqa qcaqqqqaat tqatccqqtq qatqaccttt tqaatqacct 3000 ttaatagatt atattactaa ttaattgggg accctagagg tccccttttt tattttaaaa 3060 attitttcac aaaacggitt acaagcataa agcitggcac tggccgtcgt titacaacgt 3120 cgtgactggg aaaaccctgg cgttacccaa cttaatcgcc ttgcagcaca tccccctttc 3180 gccagctggc gtaatagcga agaggcccgc accgatcgcc cttcccaaca gttgcgcagc 3240 ctgaatggcg aatggcgcct gatgcggtat tttctcctta cgcatctgtg cggtatttca 3300 caccgcatat ggtgcactct cagtacaatc tgctctgatg ccgcatagtt aagccagccc 3360 cgacacccgc caacacccgc tgacgcgccc tgacgggctt gtctgctccc ggcatccgct 3420 tacagacaag ctgtgaccgt ctccgggage tgcatgtgtc agaggttttc accgtcatca 3480 ccgaaacgcg cgagacgaaa gggcctcgtg atacgcctat ttttataggt taatgtcatg 3540 ataataatgg tttcttagac gtcaggtggc acttttcggg gaaatgtgcg cggaacccct 3600 atttgtttat ttttctaaat acattcaaat atgtatccgc tcatgagaca ataaccctga 3660 taaatgette aataatattg aaaaaggaag agtatgagta tteaacattt eegtgtegee 3720 cttattccct tttttgcggc attttgcctt cctgtttttg ctcacccaga aacgctggtg 3780 aaagtaaaag atgctgaaga tcagttgggt gcacgagtgg gttacatcga actggatctc 3840 aacagcggta agatccttga gagttttcgc cccgaagaac gttttccaat gatgagcact 3900 tttaaagttc tgctatgtgg cgcggtatta tcccgtattg acgccgggca agagcaactc 3960 ggtegeegea tacactatte teagaatgae ttggttgagt acteaceagt cacagaaaag 4020 catcttacgg atggcatgac agtaagagaa ttatgcagtg ctgccataac catgagtgat 4080 aacactgcgg ccaacttact tetgacaacg ateggaggae egaaggaget aacegetttt 4140 ttgcacaaca tgggggatca tgtaactcgc cttgatcgtt gggaaccgga gctgaatgaa 4200 gccataccaa acgacgagcg tgacaccacg atgcctgtag caatggcaac aacgttgcgc 4260 aaactattaa ctggcgaact acttactcta gcttcccggc aacaattaat agactggatg 4320 gaggeggata aagttgeagg accaettetg egeteggeee tteeggetgg etggttatt 4380 getgataaat etggageegg tgagegtggg tetegeggta teattgeage aetggggeea 4440 gatggtaage cetecegtat egtagttate tacaegaegg ggagteagge aactatggat 4500 gaacgaaata gacagatcgc tgagataggt gcctcactga ttaagcattg gtaactgtca 4560 gaccaagttt actcatatat actttagatt gatttaaaac ttcattttta atttaaaagg 4620 atctaggtga agateetttt tgataatete atgaccaaaa teeettaaeg tgagtttteg 4680 ttccactgag cgtcagaccc cgtagaaaag atcaaaggat cttcttgaga tcctttttt 4740 etgegegtaa tetgetgett geaaacaaaa aaaccacege taceageggt ggtttgtttg 4800 ocggatcaag agetaceaac tetitteecg aaggtaactg getteageag agegeagata 4860 ccaaatactg teettetagt gtageegtag ttaggeeace aetteaagaa etetgtagea 4920 obgeotabat acotogotot gotaatootg ttaccagtgg otgotgobag tggogataag 4980 tegtgtetta eegggttgga eteaagaega tagttaeegg ataaggegea geggteggge 5040 tgaacggggg gttcgtgcac acagcccagc ttggagcgaa cgacctacac cgaactgaga 5100 tacctacage gtgagetatg agaaagegee aegetteeeg aagggagaaa ggeggacagg 5160 tateeggtaa geggeagggt eggaacagga gagegeaega gggagettee agggggaaac 5220 geetggtate titatagtee tgtegggtit egecacetet gaetigageg tegatititig 5280 tgatgetegt eagggggeg gageetatgg aaaaaegeea geaaegegge eitititaegg 5340 tieetggeet titgetgee tittgeteae atgitetite etgegtiate eeetgatiet 5400 gtggataace gtattaeege eititgagtga getgataeeg etegeegeag eegaaegaee 5460 gagegeageg agteagtgag egaggaageg gaaga 5495

```
<210> 5
<211> 4189
<212> DNA
<213> Artificial Sequence
<220>
<223> Description of Artificial Sequence: Plasmid
<220>
<221> gene
<222> (243)..(1021)
<223> udp
<220>
<221> gene
<222> (1037)..(1766)
<223> deoD
<400> 5
gegeecaata egeaaacege eteteecege gegttggeeg atteattaat geagetggea 60
cgacaggttt cccgactgga aagcgggcag tgagcgcaac gcaattaatg tgagttagct 120
cactcattag gcaccccagg ctttacactt tatgcttccg gctcgtatgt tgtgtggaat 180
tgtgagcgga taacaatttc acacaggaaa cagctatgac catgattacg aattcgagct 240
eggtaccate catgtecaag tetgatgttt tteatetegg eetcaetaaa aacgatttae 300
aaggggetae gettgecate gteeetggeg acceggateg tgtggaaaag ategeegege 360
tgatggataa gccggttaag ctggcatcte accgcgaatt cactacctgg cgtgcagage 420
tggatggtaa acctgttatc gtctgctcta ccggtatcgg cggcccgtct acctctattg 480
ctgttgaaga getggeaeag etgggeatte geaeetteet gegtateggt acaaegggeg 540
ctattcagcc gcatattaat gtgggtgatg teetggttae caeggegtet gteegtetgg 600
atggcgcgag cctgcacttc gcaccgctgg aattcccggc tgtcgctgat ttcgaatgta 660
cgactgcgct ggttgaagct gcgaaatcca ttggcgcgac aactcacgtt ggcgtgacag 720
ettettetga taeettetae eeaggteagg aaegttaega taettaetet ggtegegtag 780
ttogtcactt taaaggttot atggaagagt ggcaggcgat gggcgtaatg aactatgaaa 840
tggaatctgc aaccetgctg accatgtgtg caagtcaggg cetgcgtgcc ggtatggtag 900
egggtgttat egttaacege acceaqeaag agateeegaa tgetgagaeg atgaaacaaa 960
cegaaageea tgeggtgaaa ategtggtgg aageggegeg tegtetgetg taattetett 1020
gtcgactage aggaggaatt cttccatggc taccccacac attaatgcag aaatgggcga 1080
```

tttogotgac gtagttttga tgocaggoga cocgotgogt gogaagtata ttgotgaaac 1140 tttoottgaa gatgocogtg aagtgaacaa ogttogoggt atgotgggot toacoggtac 1200

ttacaaaggc cgcaaaattt ccgtaatggg tcacggtatg ggtatcccgt cctgctccat 1260 ctacaccaaa gaactgatca ccgatttcgg cgtgaagaaa attatccgcg tgggttcctg 1320 tggcgcagtt ctgccgcacg taaaactgcg cgacgtcgtt atcggtatgg gtgcctgcac 1380 cgattccaaa gttaaccgca tccgttttaa agaccatgac tttgccgcta tcgctgactt 1440 cgacatggtg cgtaacgcag tagatgcage taaagcactg ggtattgatg etcgegtggg 1500 taacctgttc tccgctgacc tgttctactc tccggacggc gaaatgttcg acgtgatgga 1560 aaaatacggc attctcggcg tggaaatgga agcggctggt atctacggcg tcgctgcaga 1620 atttggcgcg aaagccctga ccatctgcac cgtatctgac cacatccgca ctcacgagca 1680 gaccactgcc gctgagcgtc agactacctt caacgacatg atcaaaatcg cactggaatc 1740 cgttctgctg ggcgataaag agtaagtcga cctgcaggca tgcaagcttg gcactggccg 1800 tegttttaca aegtegtgae tgggaaaace etggegttae ecaaettaat egeettgeag 1860 cacatecece tttegecage tggcgtaata gegaagagge eegcacegat egecetteee 1920 aacagttgcg cagcctgaat ggcgaatggc gcctgatgcg gtattttctc cttacgcatc 1980 tgtgcggtat ttcacaccgc atatggtgca ctctcagtac aatctgctct gatgccgcat 2040 agttaagcca gccccgacac ccgccaacac ccgctgacgc gccctgacgg gcttgtctgc 2100 teceggeate egettaeaga caagetgtga eegteteegg gagetgeatg tgteagaggt 2160 tttcaccgtc atcaccgaaa cgcgcgagac gaaagggcct cgtgatacgc ctatttttat 2220 aggttaatgt catgataata atggtttctt agacgtcagg tggcactttt cggggaaatg 2280 tgogcggaac ccctatttgt ttatttttct aaatacattc aaatatgtat ccgctcatga 2340 gacaataacc ctgataaatg cttcaataat attgaaaaaag gaagagtatg agtattcaac 2400 atttccgtgt cgcccttatt cccttttttg cggcattttg ccttcctgtt tttgctcacc 2460 cagaaacgct ggtgaaagta aaagatgctg aagatcagtt gggtgcacga gtgggttaca 2520 togaactgga totcaacago ggtaagatoo ttgagagttt togooccgaa gaacgtttto 2580 caatgatgag cacttttaaa gttctgctat gtggcgcggt attatcccgt attgacgccg 2640 ggcaagagca acteggtege egeatacaet atteteagaa tgaettggtt gagtaeteae 2700 cagtcacaga aaagcatett aeggatggea tgaeagtaag agaattatge agtgetgeea 2760 taaccatgag tgataacact gcggccaact tacttctgac aacgatcgga ggaccgaagg 2820 agctaaccgc ttttttgcac aacatggggg atcatgtaac tcgccttgat cgttgggaac 2880 cggagctgaa tgaagccata ccaaacgacg agcgtgacac cacgatgcct gtagcaatgg 2940 caacaacgtt gcgcaaacta ttaactggcg aactacttac tctagcttcc cggcaacaat 3000 taatagactg gatggaggeg gataaagttg caggaccact tetgegeteg geeetteegg 3060 ctggctggtt tattgctgat aaatctggag ccggtgagcg tgggtctcgc ggtatcattg 3120 cagcactggg gccagatggt aagccctccc gtatcgtagt tatctacacg acggggagtc 3180 aggeaactat ggatgaacga aatagacaga tegetgagat aggtgeetea etgattaage 3240 attggtaact gtcagaccaa gtttactcat atatacttta gattgattta aaacttcatt 3300 tttaatttaa aaggatotag gtgaagatoo tttttgataa totoatgaco aaaatooott 3360 aacgtgagtt ttcgttccac tgagcgtcag accccgtaga aaagatcaaa ggatcttctt 3420 gagateettt ttttetgege gtaatetget gettgeaaac aaaaaaacca eegetaeeag 3480 eggtggtttg tttgeeggat caagagetae caactetttt teegaaggta aetggettea 3540 gcagagegea gataceaaat actgteette tagtgtagee gtagttagge caccaettea 3600 agaactetgt ageacegeet acataceteg etetgetaat cetgttacea gtggetgetg 3660 ccagtggcga taagtcgtgt cttaccgggt tggactcaag acgatagtta ccggataagg 3720 egeageggte gggetgaaeg gggggttegt geacacagee eagettggag egaaegaeet 3780 acaccgaact gagataccta cagcgtgage tatgagaaag egecaegett eeegaaggga 3840 gaaaggegga caggtateeg gtaageggea gggteggaac aggagagege acgagggage 3900 ttecaggggg aaacgeetgg tatetttata gteetgtegg gtttegseac etetgaettg $39\,60$ agogtogatt titgtgatgo togtoagggg ggoggagoot atggaaaaac gooagcaacg 4020 aggestitti adggitesig gestittget ggestritge teacatytic titesigegi 4080

tatcccctga ttctgtggat aaccgtatta ccgcctttga gtgagctgat accgctcgcc 4140 qcagccgaac gaccgagcg agcgagtcag tgagcgagga agcggaaga 4189

```
<210> 6
<211> 6301
<212> DNA
<213> Artificial Sequence
<220>
<223> Description of Artificial Sequence: Plasmid
<220>
<221> gene
<222> (243)..(1021)
<223> udp
<220>
<221> gene
<222> (1037)..(1766)
<223> deoD
<220>
<221> gene
<222> (2229)..(3628)
<223> tetracycline resistance
<400> 6
gcgcccaata cgcaaaccgc ctctccccgc gcgttggccg attcattaat gcagctggca 60
cqacaqqttt cccqactqqa aaqcqqqcaq tqaqcqcaac qcaattaatg tqaqttagct 120
cactcattag gcaccccagg ctttacactt tatgetteeg gctegtatgt tgtgtggaat 180
tgtgagcgga taacaatttc acacaggaaa cagctatgac catgattacg aattcgagct 240
eggtaceate catgteeaag tetgatgttt tteatetegg eetcaetaaa aacgatttae 300
aaggggctac gcttgccatc gtccctggcg acccggatcg tgtggaaaag atcgccgcgc 360
tgatggataa geeggttaag etggeatete acegegaatt eactaeetgg egtgeagage 420
tggatggtaa acctgttatc gtctgctcta ccggtatcgg cggcccgtct acctctattg 480
ctgttgaaga gctggcacag ctgggcattc gcaccttcct gcgtatcggt acaacgggcg 540
ctattcagcc gcatattaat gtgggtgatg tcctggttac cacggcgtct gtccgtctgg 600
atggcgcgag cctgcacttc gcaccgctgg aattcccggc tgtcgctgat ttcgaatgta 660
cgactgcgct ggttgaagct gcgaaatcca ttggcgcgac aactcacgtt ggcgtgacag 720
cttcttctga taccttctac ccaggtcagg aacgttacga tacttactct ggtcgcgtag 780
ttogtcactt taaaggttot atggaagagt ggcaggcgat/gggcgtaatg aactatgaaa 840
tggaatctgc aaccetgctg accatgtgtg caagtcaggg cetgegtgee ggtatggtag 900
egggtgttat egttaacege acceageaag agatecegaa tgetgagaeg atgaaacaaa 960
cogaaageca tgeggtgaaa ategtggtgg aageggegeg tegtetgetg taattetett 1020
gtogactago aggaggaatt ottocatggo tacoccacao attaatgoag aaatgggoga 1080
tttogotgac gtagttttga tgodaggoga occgotgogt gogaagtata ttgotgaaac 1140
```

tttoottgaa gatgooogtg aagtgaacaa ogttogoggt atgotgggot toacoggtac 1200

ttacaaagge cgcaaaattt ccgtaatggg tcacggtatg ggtatcccgt cctgctccat 1260 ctacaccaaa qaactqatca ccgatttcgg cgtgaagaaa attatccgcg tgggttcctg 1320 tggcgcagtt ctgccgcacg taaaactgcg cgacgtcgtt atcggtatgg gtgcctgcac 1380 cgattccaaa gttaaccgca tccgttttaa agaccatgac tttgccgcta tcgctgactt 1440 cgacatggtg cgtaacgcag tagatgcagc taaagcactg ggtattgatg ctcgcgtggg 1500 taacctgttc tccgctgacc tgttctactc tccggacggc gaaatgttcg acgtgatgga 1560 aaaatacggc attctcggcg tggaaatgga agcggctggt atctacggcg tcgctgcaga 1620 atttggcgcg aaagecetga ecatetgeae egtatetgae cacateegea etcaegagea 1680 qaccactgcc gctgagcgtc agactacctt caacgacatg atcaaaatcg cactggaatc 1740 cgttctgctg ggcgataaag agtaagtcga cctgcaggca tgcaagcttt atgcttgtaa 1800 acceptttgt gaaaaaattt ttaaaaataaa aaaggggacc tctagggtcc ccaattaatt 1860 agtaatataa totattaaag gtoattoaaa aggtoatooa coggatoago ttagtaaago 1920 cctcgctaga ttttaatgcg gatgttgcga ttacttcgcc aactattgcg ataacaagaa 1980 aaagccagcc tttcatgata tatctcccaa tttgtgtagg gcttattatg cacgcttaaa 2040 aataataaaa gcagacttga cctgatagtt tggctgtgag caattatgtg cttagtgcat 2100 ctaacgcttg agttaagccg cgccgcgaag cggcgtcggc ttgaacgaat tgttagacat 2160 tatttgccga ctaccttggt gatctcgcct ttcacgtagt ggacaaattc ttccaactga 2220 totgogogo gagatgogo gogtgoggot gotggagatg goggacgoga tggatatgtt 2280 ctgccaaggg ttggtttgcg cattcacagt tctccgcaag aattgattgg ctccaattct 2340 tggagtggtg aatccgttag cgaggtgccg ccggcttcca ttcaggtcga ggtggcccgg 2400 ctccatgcac cgcgacgcaa cgcggggagg cagacaaggt atagggcggc gcctacaatc 2460 catgccaacc cgttccatgt gctcgccgag gcggcataaa tcgccgtgac gatcagcggt 2520 ccagtgatcg aagttaggct ggtaagagcc gcgagcgatc cttgaagctg tccctgatgg 2580 tegteateta eetgeetgga cageatggee tgeaaegegg geateeegat geegeeggaa 2640 gcgagaagaa tcataatggg gaaggccatc cagcctcgcg tcgcgaacgc cagcaagacg 2700 tageceageg egteggeege catgeeggeg ataatggeet gettetegee gaaacgtttg 2760 gtggcgggac cagtgacgaa ggcttgagcg agggcgtgca agattccgaa taccgcaagc 2820 qacaqqeeqa teateqteqe qetecaqeqa aageqgteet egeegaaaat gacecagage 2880 qctqccqqca cctqtcctac qaqttqcatq ataaagaaga cagtcataag tgcggcgacg 2940 atagtcatgc cccgcgccca ccggaaggag ctgactgggt tgaaggctct caagggcatc 3000 ggtcgacgct ctcccttatg cgactcctgc attaggaagc agcccagtag taggttgagg 3060 ccgttgagca ccgccgccgc aaggaatggt gcatgcaagg agatggcgcc caacagtccc 3120 ccggccacgg ggcctgccac catacccacg ccgaaacaag cgctcatgag cccgaagtgg 3180 cgagcccgat cttccccatc ggtgatgtcg gcgatatagg cgccagcaac cgcacctgtg 3240 gegeeggtga tgeeggeeae gatgegteeg gegtagagga teeaeaggae gggtgtggte 3300 gccatgatcg cgtagtcgat agtggctcca agtagcgaag cgagcaggac tgggcggcgg 3360 ccaaagcggt cggacagtgc tccgagaacg ggtgcgcata gaaattgcat caacgcatat 3420 agegetagea geaegeeata gtgactggeg atgetgtegg aatggaegat atecegeaag 3480 aggeceggea gtaceggeat aaccaageet atgeetacag catecagggt gaeggtgeeg 3540 aggatgacga tgagcgcatt gttagatttc atacacggtg cctgactgcg ttagcaattt 3600 aactgtgata aactaccgca ttaaagctca tgcggatcag tgagggtttg caactgcggg 3660 teaaggatet ggatttegat caeggeaega teategtgeg ggagggeaag ggeteeaagg 3720 ategggeett gatgttacee gagagettgg caeceageet gegegageag gggaattgat 3780 coggtggatg accttttgaa tgacctttaa tagattatat tactaattaa ttggggaccc 3840 tagaggtccc cttttttatt ttaaaaattt tttcacaaaa cggtttacaa gcataaagct 3900 tggcactggc cgtcgtttta caacgtcgtg actgggaaaa ccctggcgtt acccaactta 3960 ategeettge ageacatece eetttegeea getggegtaa tagegaagag geeegeaceg 4020 atogocotto coaacagttg ogcagootga atggogaatg gogoctgatg oggtattttc 4080 teettaegea tetgtgeggt attteaeace geatatggtg caeteteagt acaatetget 4140 ctgatgccgc atagttaagc cagccccgac acccgccaac acccgctgac gcgccctgac 4200 qqqcttqtct gctcccgqca tccgcttaca gacaagctgt gaccgtctcc gggagctgca 4260 tgtgtcagag gttttcaccg tcatcaccga aacgcgcgag acgaaagggc ctcgtgatac 4320 qcctattttt ataggttaat gtcatgataa taatggtttc ttagacgtca ggtggcactt 4380 ttcqqqqaaa tqtqcqcqqa acccctattt gtttattttt ctaaatacat tcaaatatgt 4440 atcogctcat gagacaataa coctgataaa tgcttcaata atattgaaaa aggaagagta 4500 tgagtattca acatttccgt gtcgccctta ttcccttttt tgcggcattt tgccttcctg 4560 tttttgctca cccaqaaacg ctqqtqaaaq taaaaqatqc tqaaqatcaq ttqgqtqcac 4620 qaqtqqqtta catcqaactq gatctcaaca qcqqtaaqat ccttqaqaqt tttcqccccq 4680 aagaacgttt tecaatgatg agcaetttta aagttetget atgtggegeg gtattateee 4740 gtattgacgc cgggcaagag caactcggtc gccgcataca ctattctcag aatgacttgg 4800 ttgagtactc accagtcaca gaaaagcatc ttacggatgg catgacagta agagaattat 4860 qcaqtqctqc cataaccatg agtgataaca ctgcggccaa cttacttctg acaacgatcg 4920 qaqqaccqaa qqaqctaacc gcttttttgc acaacatggg ggatcatgta actcgccttg 4980 atcgttggga accggagctg aatgaagcca taccaaacga cgagcgtgac accacgatgc 5040 ctgtagcaat ggcaacaacg ttgcgcaaac tattaactgg cgaactactt actctagctt 5100 cccggcaaca attaatagac tggatggagg cggataaagt tgcaggacca cttctgcgct 5160 eggeeettee ggetggetgg tttattgetg ataaatetgg ageeggtgag egtgggtete 5220 geggtateat tgeageactg gggeeagatg gtaageeete eegtategta gttatetaca 5280 cqacqqqqaq tcaqqcaact atqqatqaac gaaatagaca gatcqctgag atagqtqcct 5340 cactgattaa gcattggtaa ctgtcagacc aagtttactc atatatactt tagattgatt 5400 taaaacttca tttttaattt aaaaggatct aggtgaagat cctttttgat aatctcatga 5460 ccaaaatccc ttaacgtgag ttttcgttcc actgagcgtc agaccccgta gaaaagatca 5520 aaqqatcttc ttgagatect ttttttctgc gegtaatctg ctgcttgcaa acaaaaaaac 5580 caccyctacc agcygtgytt tytttgccyg atcaagagct accaactett tttccgaagg 5640 taactggctt cagcagagcg cagataccaa atactgtcct tctagtgtag ccgtagttag 5700 qccaccactt caaqaactct gtagcaccgc ctacatacct cgctctgcta atcctgttac 5760 cagtggctgc tgccagtggc gataagtcgt gtcttaccgg gttggactca agacgatagt 5820 taccqqataa qqcqcaqcqq tcqqqctgaa cqgqqqqttc qtqcacacaq cccaqcttgg 5880 agogaacgac ctacaccgaa ctgagatacc tacagcgtga gctatgagaa agogccacgc 5940 ttcccgaagg gagaaaggcg gacaggtatc cggtaagcgg cagggtcgga acaggagagc 6000 gcacgaggga gcttccaggg ggaaacgcct ggtatcttta tagtcctgtc gggtttcgcc 6060 acctctgact tgagcgtcga tttttgtgat gctcgtcagg ggggcggagc ctatggaaaa 6120 acqccaqcaa cqcqqccttt ttacqqttcc tqqccttttq ctqqcctttt gctcacatqt 6180 tettteetge gttateeeet gattetgtgg ataacegtat tacegeettt gagtgagetg 6240 ataccgctcg ccgcagccga acgaccgagc gcagcgagtc agtgagcgag gaagcggaag 6300 6301 а

```
<210> 7
<211> 5241
```

<212> DNA

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Plasmid

<220>
<221> gene
<222> (1312)..(2042)
<223> deoD

<400> 7

atcgatgcat aatgtgcctg tcaaatggac gaagcaggga ttctgcaaac cctatgctac 60 teegteaage egteaattgt etgattegtt accaattatg acaaettgae ggetaeatea 120 ttcacttttt cttcacaacc ggcacggaac tcgctcgggc tggccccggt gcatttttta 180 aatacccgcg agaaatagag ttgatcgtca aaaccaacat tgcgaccgac ggtggcgata 240 ggcatceggg tggtgctcaa aagcagette geetggetga taegttggte etegegeeag 300 cttaagacgc taatccctaa ctgctggcgg aaaagatgtg acagacgcga cggcgacaag 360 caaacatgct gtgcgacgct ggcgatatca aaattgctgt ctgccaggtg atcgctgatg 420 tactgacaag cetegegtae eegattatee ateggtggat ggagegaete gttaateget 480 tocatgegee geagtaacaa ttgeteaage agatttateg eeageagete egaatagege 540 ccttcccctt gcccggcgtt aatgatttgc ccaaacaggt cgctgaaatg cggctggtgc 600 gcttcatccg ggcgaaagaa ccccgtattg gcaaatattg acggccagtt aagccattca 660 tgccagtagg cgcgcggacg aaagtaaacc cactggtgat accattcgcg agcctccgga 720 tgacgaccgt agtgatgaat ctctcctggc gggaacagca aaatatcacc cggtcggcaa 780 acaaattctc gtccctgatt tttcaccacc ccctgaccgc gaatggtgag attgagaata 840 taacetttea tteecagegg teggtegata aaaaaatega gataacegtt ggeeteaate 900 ggcgttaaac ccgccaccag atgggcatta aacgagtatc ccggcagcag gggatcattt 960 tgcgcttcag ccatactttt catactcccg ccattcagag aagaaaccaa ttgtccatat 1020 tgcatcagac attgccgtca ctgcgtcttt tactggctct tctcgctaac caaaccggta 1080 accocgetta ttaaaagcat tetgtaacaa agegggacca aagecatgae aaaaaegegt 1140 aacaaaagtg totataatca cggcagaaaa gtccacattg attatttgca cggcgtcaca 1200 ctttgctatg ccatagcatt tttatccata agattagcgg atcctacctg acgcttttta 1260 tegeaactet etactgitte teeataceeg tittittiggg etageaggag ggaattette 1320 catggctacc ccacacatta atgcagaaat gggcgatttc gctgacgtag ttttgatgcc 1380 aggegaceeg etgegtgega agtatattge tgaaaettte ettgaagatg eeegtgaagt 1440 gaacaacgtt cgcggtatgc tgggcttcac cggtacttac aaaggccgca aaatttccgt 1500 aatgggtcac ggtatgggta tecegteetg etecatetae accaaagaae tgateacega 1560 tttcggcgtg aagaaatta tccgcgtggg ttcctgtggc gcagttctgc cgcacgtaaa 1620 actgcgcgac gtcgttatcg gtatgggtgc ctgcaccgat tccaaagtta accgcatccg 1680 ttttaaagac catgactttg ccgctatcgc tgacttcgac atggtgcgta acgcagtaga 1740 tgcagctaaa gcactgggta ttgatgctcg cgtgggtaac ctgttctccg ctgacctgtt 1800 ctactctccg gacggcgaaa tgttcgacgt gatggaaaaa tacggcattc tcggcgtgga 1860 aatggaagcg getggtatet acggegtege tgeagaattt ggegegaaag eeetgaceat 1920 ctgcaccgta tctgaccaca tccgcactca cgagcagacc actgccgctg agcgtcagac 1980 tacetteaac gacatgatea aaategeact ggaateegtt etgetgggeg ataaagagta 2040 agtogacetg caggoatgca agettggetg ttttggegga tgagagaaga ttttcageet 2100 gatacagatt aaatcagaac gcagaagcgg tctgataaaa cagaatttgc ctggcggcag 2160 tagegeggtg gteceaeetg acceeatgee gaacteagaa gtgaaaegee gtagegeega 2220 tggtagtgtg gggtctcccc atgcgagagt agggaactgc caggcatcaa ataaaacgaa 2280 aggeteagte gaaagaetgg geetttegtt ttatetgttg tttgteggtg aaegetetee 2340 tgagtaggac aaatccgccg ggagcggatt tgaacgttgc gaagcaacgg cccggagggt 2400 ggogggoagg acgeecgeea taaactgeea ggeatcaaat taageagaag gecateetga 2460 eggatggeet tittgegitt etacaaacte tittgiitat tittetaaat acatteaaat 2520 atgtatccgc tcatgagaca ataaccctga taaatgcttc aataatattg aaaaaggaag 2580 agtatgagta ttcaacattt ccgtgtcgcc cttattccct tttttgcggc attttgcctt 2640 cctgtttttg ctcacccaga aacgctggtg aaagtaaaag atgctgaaga tcagttgggt 2700 gcacgagtgg gttacatcga actggatctc aacagcggta agatccttga gagttttcgc 2760 cccgaagaac gttttccaat gatgagcact tttaaagttc tgctatgtgg cgcggtatta 2820 tecegtgttg aegeegggea agageaacte ggtegeegea tacaetatte teagaatgae 2880 ttqqttgagt actcaccagt cacagaaaag catcttacgg atggcatgac agtaagagaa 2940 ttatgcagtg ctgccataac catgagtgat aacactgcgg ccaacttact tctgacaacg 3000 atcqqaqqac cqaaqqaqct aaccqctttt ttqcacaaca tqqqqqatca tqtaactcqc 3060 cttgatcgtt gggaaccgga gctgaatgaa gccataccaa acgacgagcg tgacaccacg 3120 atgcctgtag caatggcaac aacgttgcgc aaactattaa ctggcgaact acttactcta 3180 gcttcccggc aacaattaat agactggatg gaggcggata aagttgcagg accacttctg 3240 egeteggeee tteeggetgg etggtttatt getgataaat etggageegg tgagegtggg 3300 tctcgcggta tcattgcagc actggggcca gatggtaagc cctcccgtat cgtagttatc 3360 tacacgacgg ggagtcaggc aactatggat gaacgaaata gacagatcgc tgagataggt 3420 geeteactga ttaageattg gtaactgtea gaceaagttt aeteatatat aetttagatt 3480 gatttacgeg ceetgtageg gegeattaag egeggegggt gtggtggtta egegeagegt 3540 gaccgctaca cttgccagcg ccctagcgcc cgctcctttc getttcttcc cttcctttct 3600 cgccacgttc gccggctttc cccgtcaagc tctaaatcgg gggctccctt tagggttccg 3660 atttagtget ttaeggeace tegaceceaa aaaaettgat ttgggtgatg gtteaegtag 3720 tgggccatcg ccctgataga cggtttttcg ccctttgacg ttggagtcca cgttctttaa 3780 tagtggactc ttgttccaaa cttgaacaac actcaaccet ateteggget attettttga 3840 tttataaggg attttgccga tttcggccta ttggttaaaa aatgagctga tttaacaaaa 3900 atttaacgcg aattttaaca aaatattaac gtttacaatt taaaaggatc taggtgaaga 3960 teettittga taateteatg accaaaatee ettaaegtga gttttegtte eaetgagegt 4020 cagaccccgt agaaaagatc aaaggatctt cttgagatcc tttttttctg cgcgtaatct 4080 gctgcttgca aacaaaaaa ccaccgctac cagcggtggt ttgtttgccg gatcaagagc 4140 taccaactet titteegaag giaactgget teageagage geagatacea aatactgtee 4200 ttctagtgta gccgtagtta ggccaccact tcaagaactc tgtagcaccg cctacatacc 4260 tegetetget aateetgtta ceagtggetg etgecagtgg egataagteg tgtettaeeg 4320 ggttggactc aagacgatag ttaccggata aggcgcagcg gtcgggctga acggggggtt 4380 cgtgcacaca gcccagcttg gagcgaacga cctacaccga actgagatac ctacagcgtg 4440 agctatgaga aagcgccacg cttcccgaag ggagaaaggc ggacaggtat ccggtaagcg 4500 ${\tt gcagggtcgg} \ \ {\tt aacaggagag} \ \ {\tt cgcacgaggg} \ \ {\tt agcttccagg} \ \ {\tt gggaaacgcc} \ \ {\tt tggtatcttt} \ \ {\tt 4560}$ atagteetgt egggtttege eacetetgae ttgagegteg atttttgtga tgetegteag 4620 gggggcggag cetatggaaa aacgccagca acgcggcett tttacggtte etggcetttt 4680 gctggccttt tgctcacatg ttctttcctg cgttatcccc tgattctgtg gataaccgta 4740 ttaccgcctt tgagtgagct gataccgctc gccgcagccg aacgaccgag cgcagcgagt 4800 cagtgagcga ggaagcggaa gagcgcctga tgcggtattt tctccttacg catctgtgcg 4860 gtatttcaca cogcataggg toatggctgc gccccgacac cogccaacac cogctgacgc 4920 gccctgacgg gcttgtctgc teceggcate egettacaga caagetgtga eegteteegg 4980 gagetgeatg tgteagaggt ttteacegte ateacegaaa egegegagge ageaaggaga 5040 tggcgcccaa cagtcccccg gccacggggc ctgccaccat acccacgccg aaacaagcgc 5100 tcatgagece gaagtggega geoegatett ceceateggt gatgteggeg atataggege 5100 cagcaacogo acctgtggog coggtgatgo cggccacgat gogtcoggog tagaggatot 52205241 gctcatgttt gacagcttat c

<210> 8 <211> 5822 <212> DNA <213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: pGM716 with deletion of HpaI fragment

<400> 8 gegeecaata egeaaacege eteteceege gegttggeeg atteattaat geagetggea 60 cqacagqttt cccgactgga aagcgggcag tgagcgcaac gcaattaatg tgagttagct 120 cactcattag gcaccccagg ctttacactt tatgcttccg gctcgtatgt tgtgtggaat 180 tgtgagegga taacaattte acacaggaaa cagetatgae catgattaeg aattegaget 240 eggtaceate catgteeaag tetgatgttt tteatetegg eeteactaaa aacgatttae 300 aaggggetae gettgeeate gteeetggeg acceggateg tgtggaaaag ategeegege 360 tgatggataa geeggttaag etggeatete aeegegaatt eaetaeetgg egtgeagage 420 tggatggtaa acctgttatc gtctgctcta ccggtatcgg cggcccgtct acctctattg 480 ctgttgaaga gctggcacag ctgggcatte gcacetteet gcgtateggt acaacgggeg 540 ctattcagcc gcatattaat gtgggtgatg teetggttae caeggegtet gteegtetgg 600 atggcgcgag cctgcacttc gcaccgctgg aattcccggc tgtcgctgat ttcgaatgta 660 cgactgcgct ggttgaaget gcgaaatcca ttggcgcgac aactcacgtt ggcgtgacag 720 cttcttctga taccttctac ccaggtcagg aacgttacga tacttactct ggtcgcgtag 780 ttcgtcactt taaaggttct atggaagagt ggcaggcgat gggcgtaatg aactatgaaa 840 tggaatctgc accetgctg accatgtgtg caagtcaggg cctgcgtgcc ggtatggtag 900 egggtgttat egttaacege atecgtttta aagaceatga etttgeeget ategetgaet 960 tegacatggt gegtaaegea gtagatgeag etaaageaet gggtattgat getegegtgg 1020 gtaacctgtt ctccgctgac ctgttctact ctccggacgg cgaaatgttc gacgtgatgg 1080 aaaaatacgg cattctcggc gtggaaatgg aagcggctgg tatctacggc gtcgctgcag 1140 aatttggcgc gaaagccctg accatctgca ccgtatctga ccacatccgc actcacgagc 1200 agaccactgc cgctgagcgt cagactacct tcaacgacat gatcaaaatc gcactggaat 1260 ccgttctgct gggcgataaa gagtaagtcg acctgcaggc atgcaagctt tatgcttgta 1320 aaccgttttg tgaaaaaatt tttaaaataa aaaaggggac ctctagggtc cccaattaat 1380 tagtaatata atctattaaa ggtcattcaa aaggtcatcc accggatcag cttagtaaag 1440 ccctcgctag attttaatgc ggatgttgcg attacttcgc caactattgc gataacaaga 1500 aaaagccagc ctttcatgat atatctccca atttgtgtag ggcttattat gcacgcttaa 1560 aaataataaa agcagacttg acctgatagt ttggctgtga gcaattatgt gcttagtgca 1620 tctaacgctt gagttaagcc gcgccgcgaa gcggcgtcgg cttgaacgaa ttgttagaca 1680 ttatttgccg actaccttgg tgatctcgcc tttcacgtag tggacaaatt cttccaactg 1740 atetgegege egagatgege egegtgegge tgetggagat ggeggaegeg atggatatgt 1800 tetgecaagg gttggtttge geatteaeag tteteegeaa gaattgattg geteeaatte 1860 ttggagtggt gaateegtta gegaggtgee geeggettee atteaggteg aggtggeeeg 1920 gctccatgca ccgcgacgca acgcggggag gcagacaagg tatagggcgg cgcctacaat 1980 ccatgccaac cogttccatg tgctcgccga ggcggcataa atcgccgtga cgatcagcgg 2040 tocagtgate gaagttagge tggtaagage egegagegat cettgaaget gteeetgatg 2100 gtogtoatot acotgootgg acagoatggo otgoaacgog ggoatocoga tgoogcogga 2160 agegagaaga atcataatgg ggaaggeeat eeageetege gtegegaaeg eeageaagae 2220 gtageceage gegteggeeg ecatgeegge gataatggee tgettetege egaaaegttt 2280

ggtggcggga ccagtgacga aggcttgagc gagggcgtgc aagattccga ataccgcaag 2340 cgacaggeeg atcategteg egetecageg aaageggtee tegeegaaaa tgacecagag 2400 cgctgccggc acctgtccta cgagttgcat gataaagaag acagtcataa gtgcggcgac 2460 gatagtcatg ccccgcgccc accggaagga gctgactggg ttgaaggctc tcaagggcat 2520 cggtcgacgc tetecettat gegacteetg cattaggaag cageccagta gtaggttgag 2580 gccgttgagc accgccgccg caaggaatgg tgcatgcaag gagatggcgc ccaacagtcc 2640 cccggccacg gggcctgcca ccatacccac gccgaaacaa gcgctcatga gcccgaagtg 2700 gegageeega tetteeecat eggtgatgte ggegatatag gegeeageaa eegeaeetgt 2760 ggcgccggtg atgccggcca cgatgcgtcc ggcgtagagg atccacagga cgggtgtggt 2820 cgccatgatc gcgtagtcga tagtggctcc aagtagcgaa gcgagcagga ctgggcggcg 2880 gccaaagcgg tcggacagtg ctccgagaac gggtgcgcat agaaattgca tcaacgcata 2940 tagcgctagc agcacgccat agtgactggc gatgctgtcg gaatggacga tatcccgcaa 3000 gaggcccggc agtaccggca taaccaagcc tatgcctaca gcatccaggg tgacggtgcc 3060 gaggatgacg atgagcgcat tgttagattt catacacggt gcctgactgc gttagcaatt 3120 taactgtgat aaactaccgc attaaagctc atgcggatca gtgagggttt gcaactgcgg 3180 gtcaaggatc tggatttcga tcacggcacg atcatcgtgc gggagggcaa gggctccaag 3240 gatcgggcct tgatgttacc cgagagcttg gcacccagcc tgcgcgagca ggggaattga 3300 teeggtggat gacettttga atgacettta atagattata ttaetaatta attggggaee 3360 ctagaggtcc ccttttttat tttaaaaatt ttttcacaaa acggtttaca agcataaagc 3420 ttggcactgg ccgtcgtttt acaacgtcgt gactgggaaa accctggcgt tacccaactt 3480 aatcgccttg cagcacatcc ccctttcgcc agctggcgta atagcgaaga ggcccgcacc 3540 gatcgccctt cccaacagtt gcgcagcctg aatggcgaat ggcgcctgat gcggtatttt 3600 ctccttacgc atctgtgcgg tatttcacac cgcatatggt gcactctcag tacaatctgc 3660 totgatgoog catagttaag coagocooga caccogocaa caccogotga cgcgccctga 3720 egggettgte tgeteeegge ateegettae agacaagetg tgacegtete egggagetge 3780 atgtgtcaga ggttttcacc gtcatcaccg aaacgcgcga gacgaaaggg cctcgtgata 3840 cgcctatttt tataggttaa tgtcatgata ataatggttt cttagacgtc aggtggcact 3900 tttcggggaa atgtgcgcgg aacccctatt tgtttatttt tctaaataca ttcaaatatg 3960 tatccgctca tgagacaata accctgataa atgcttcaat aatattgaaa aaggaagagt 4020 atgagtattc aacatttccg tgtcgccctt attccctttt ttgcggcatt ttgccttcct 4080 gtttttgctc acccagaaac gctggtgaaa gtaaaagatg ctgaagatca gttgggtgca 4140 cgagtgggtt acatcgaact ggatctcaac agcggtaaga tccttgagag ttttcgcccc 4200 gaagaacgtt ttccaatgat gagcactttt aaagttctgc tatgtggcgc ggtattatcc 4260 cgtattgacg ccgggcaaga gcaactcggt cgccgcatac actattctca gaatgacttg 4320 gttgagtact caccagtcac agaaaagcat cttacggatg gcatgacagt aagagaatta 4380 tgcagtgctg ccataaccat gagtgataac actgcggcca acttacttct gacaacgatc 4440 ggaggaccga aggagctaac cgcttttttg cacaacatgg gggatcatgt aactcgcctt 4500 gategttggg aaceggaget gaatgaagee ataccaaacg acgagegtga caccacgatg 4560 cctgtagcaa tggcaacaac gttgcgcaaa ctattaactg gcgaactact tactctagct 4620 teceggeaac aattaataga etggatggag geggataaag ttgeaggace aettetgege 4680 teggeeette eggetggetg gtttattget gataaatetg gageeggtga gegtgggtet 4740 cgcggtatca ttgcagcact ggggccagat ggtaagccct cccgtatcgt agttatctac 4800 acgacgggga gtcaggcaac tatggatgaa cgaaatagac agatcgctga gataggtgcc 4860 toactgatta agcattggta actgtcagac caagtttact catatatact ttagattgat 4920 ttaaaacttc atttttaatt taaaaggatc taggtgaaga teetttttga taateteatg 4980 accaaaatcc cttaacgtga gttttcgttc cactgagcgt cagaccccgt agaaaagatc 5040 aaaggatett ettgagatee tittitetg egegtaatet getgettgea aacaaaaaa 5100 ccaccgctac cagcggtggt tigttigccg gatcaagagc taccaactct tittccgaag 5160 gtaactggct tcagcagagc gcagatacca aatactgtce ttctagtgta gccgtagtta 5220 ggccaccact tcaagaacte tgtagcaccg cctacatace tcgctctgct aatactgtta 5280 ccagtggctg ctgccagtgg cgataagtcg tgtcttaccg ggttggacte aagacgatag 5340 ttaccggata aggcgcagcg gtcgggctga acggggggtt cgtgcacaca gcccagcttg 5400 gagcgaacga cctacaccga actgagatac ctacagcgtg agctatgaga aagcgccacg 5460 cttcccgaag ggagaaaggc ggacaggtat ccggtaagcg gcagggtcgg aacaggagag 5520 cgcacgaggg agcttccagg gggaaacgcc tggtatctt atagtcctgt cgggtttcgc 5580 cacctctgac ttgagcgtcg atttttgtga tgctcgtcag gggggcggag cctatggaaa 5640 aacgccagca acgcggcctt tttacggttc ctggccttt gctggcctt tgctcacatg 5700 ttcttcctg cgttatccc tgattctgt gataaccgta ttaccgcctt tgagtgagct 5760 gataccgctc gccgcagccg aacgaccgag cgcagcgagt cagtgagcag ggaagcggaa 5820 ga

<210> 9

<211> 6269

<212> DNA

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: udp and deoD cloned in pUC18 so to create a fusion between the two proteins

<400> 9 gcgcccaata cgcaaaccgc ctctccccgc gcgttggccg attcattaat gcagctggca 60 cgacaggttt cccgactgga aagcgggcag tgagcgcaac gcaattaatg tgagttagct 120 cactcattag gcacccagg ctttacactt tatgcttccg gctcgtatgt tgtgtggaat 180 tgtgagcgga taacaatttc acacaggaaa cagctatgac catgattacg aattcgagct 240 cggtaccatc catgtccaag tctgatgttt ttcatctcgg cctcactaaa aacgatttac 300 aaqqqqctac qcttqccatc qtccctqqcq acccqgatcq tgtggaaaag atcgccgcgc 360 tgatggataa gccggttaag ctggcatctc accgcgaatt cactacctgg cgtgcagagc 420 tggatggtaa acctgttate gtetgeteta eeggtategg eggeeegtet acctetattg 480 ctgttgaaga getggeacag etgggeatte geacetteet gegtateggt acaaegggeg 540 ctattcagcc gcatattaat gtgggtgatg tcctggttac cacggcgtct gtccgtctgg 600 atggcgcgag cctgcacttc gcaccgctgg aattcccggc tgtcgctgat ttcgaatgta 660 cgactgcgct ggttgaagct gcgaaatcca ttggcgcgac aactcacgtt ggcgtgacag 720 cttcttctga taccttctac ccaggtcagg aacgttacga tacttactct ggtcgcgtag 780 ttcgtcactt taaaggttct atggaagagt ggcaggcgat gggcgtaatg aactatgaaa 840 tggaatctgc aaccctgctg accatgtgtg caagtcaggg cctgcgtgcc ggtatggtag 900 cgggtgttat cgttaaccgc acccagcaag agatcccgaa tgctgagacg atgaaacaaa 960 ccgaaagcca tgcggtgaaa atcgtggtgg aagcggcgcg tcgtctgctg tccatggcta 1020 ccccacacat taatgcagaa atgggcgatt tcgctgacgt agttttgatg ccaggcgacc 1080 cgctgcgtgc gaagtatatt gctgaaactt tccttgaaga tgcccgtgaa gtgaacaacg 1140 ttogoggtat gotgggotto acoggtactt acaaaggcog caaaatttoo gtaatgggto 1200 acqqtatqqq tatcccqtcc tqctccatct acaccaaaga actgatcacc gatttcggcg 1260 tqaaqaaaat tatccqcqtq qqttcctqtq qcgcaqttct qccqcacqta aaactqcqcq 1320 acgtogttat oggtatgggt gootgcaccg attocaaagt taacegcate ogttttaaag 1380 accatgactt tgccgctatc gctgacttcg acatggtgcg taacgcagta gatgcagcta 1440 aagcactggg tattgatget egegtgggta acctgttete egetgaeetg ttetaetete 1500 cggacggcga aatgttcgac gtgatggaaa aatacggcat tctcggcgtg gaaatggaag 1560 cggctggtat ctacggcgtc gctgcagaat ttggcgcgaa agccctgacc atctgcaccg 1620 tatotgacca catoogoact caogagoaga coaotgoogo tgagogtoag actacottoa 1680 acgacatgat caaaatcgca ctggaatccg ttctgctggg cgataaagag taagtcgacc 1740 tgcaggcatg caagctttat gcttgtaaac cgttttgtga aaaaattttt aaaataaaaa 1800 aggggacctc tagggtcccc aattaattag taatataatc tattaaaggt cattcaaaag 1860 gtcatccacc ggatcagctt agtaaagccc tcgctagatt ttaatgcgga tgttgcgatt 1920 acttcgccaa ctattgcgat aacaagaaaa agccagcctt tcatgatata tctcccaatt 1980 tgtgtagggc ttattatgca cgcttaaaaa taataaaagc agacttgacc tgatagtttg 2040 gctgtgagca attatgtgct tagtgcatct aacgcttgag ttaagccgcg ccgcgaagcg 2100 gcgtcggctt gaacgaattg ttagacatta tttgccgact accttggtga tctcgccttt 2160 cacgtagtgg acaaattett ecaactgate tgegegeega gatgegeege gtgeggetge 2220 tggagatggc ggacgcgatg gatatgttct gccaagggtt ggtttgcgca ttcacagttc 2280 teegeaagaa tigatigget eeaattetig gagtggtgaa teegitageg aggtgeegee 2340 ggettecatt caggtegagg tggccegget ccatgcaceg cgacgcaacg cggggaggca 2400 gacaaggtat agggeggege ctacaateca tgccaaceeg ttecatgtge tegeegagge 2460 ggcataaatc gccgtgacga tcagcggtcc agtgatcgaa gttaggctgg taagagccgc 2520 gagegateet tgaagetgte eetgatggte gteatetace tgeetggaca geatggeetg 2580 caacgcgggc atcccgatgc cgccggaagc gagaagaatc ataatgggga aggccatcca 2640 geetegegte gegaaegeea geaagaegta geeeagegeg teggeegeea tgeeggegat 2700 aatggcctgc ttctcgccga aacgtttggt ggcgggacca gtgacgaagg cttgagcgag 2760 ggcgtgcaag attccgaata ccgcaagcga caggccgatc atcgtcgcgc tccagcgaaa 2820 geggteeteg eegaaaatga eeeagagege tgeeggeace tgteetaega gttgeatgat 2880 aaagaagaca gtcataagtg cggcgacgat agtcatgccc cgcgcccacc ggaaggagct 2940 gactgggttg aaggetetea agggeategg tegaegetet eeettatgeg acteetgeat 3000 taggaagcag cccagtagta ggttgaggcc gttgagcacc gccgccgcaa ggaatggtgc 3060 atgcaaggag atggcgccca acagtccccc ggccacgggg cctgccacca tacccacgcc 3120 gaaacaagcg ctcatgagcc cgaagtggcg agcccgatct tccccatcgg tgatgtcggc 3180 gatataggcg ccagcaaccg cacctgtggc gccggtgatg ccggccacga tgcgtccggc 3240 gtagaggatc cacaggacgg gtgtggtcgc catgatcgcg tagtcgatag tggctccaag 3300 tagcgaageg ageaggaetg ggeggeggee aaageggteg gaeagtgete egagaaeggg 3360 tgcgcataga aattgcatca acgcatatag cgctagcagc acgccatagt gactggcgat 3420 gctgtcggaa tggacgatat cccgcaagag gcccggcagt accggcataa ccaagcctat 3480 gcctacagca tccagggtga cggtgccgag gatgacgatg agcgcattgt tagatttcat 3540 acacggtgcc tgactgcgtt agcaatttaa ctgtgataaa ctaccgcatt aaagctcatg 3600 cggatcagtg agggtttgca actgcgggtc aaggatctgg atttcgatca cggcacgatc 3660 atcgtgcggg agggcaaggg ctccaaggat cgggccttga tgttacccga gagcttggca 3720 cccagcctgc gcgagcaggg gaattgatcc ggtggatgac cttttgaatg acctttaata 3780 gattatatta ctaattaatt ggggacccta gaggtcccct tttttatttt aaaaattttt 3840 tcacaaaacg gtttacaagc ataaagcttg gcactggccg tcgttttaca acgtcgtgac 3900 tgggaaaacc ctggcgttac ccaacttaat cgccttgcag cacateceec tttcgccage 3960 tggcgtaata gcgaagaggc ccgcaccgat cgcccttccc aacagttgcg cagcctgaat 4020 ggcgaatggc gcctgatgcg gtattttctc cttacgcatc tgtgcggtat ttcacaccgc 4080 atatggtgca ctctcagtac aatctgctct gatgccgcat agttaagcca gccccgacac 4140 cogocaacae cogotgacge geoctgacgg gettgtctge tecoggeate egettacaga 4200 caagetgtga eegteteegg gagetgeatg tgteagaggt ttteaeegte ateaeegaaa 4260 cgcgcgagac gaaagggcct cgtgatacgc ctatttttat aggttaatgt catgataata 4320 atggtttett agacgtcagg tggcactttt eggggaaatg tgegeggaae eectatttgt 4380 ttatttttct aaatacattc aaatatgtat ccgctcatga gacaataacc ctgataaatg 4440 cttcaataat attgaaaaag gaagagtatg agtattcaac atttccgtgt cgcccttatt 4500 cccttttttg cggcattttg ccttcctgtt tttgctcacc cagaaacgct ggtgaaagta 4560 aaaqatgctg aagatcagtt gggtgcacga gtgggttaca tcgaactgga tctcaacagc 4620 ggtaagatcc ttgagagttt tcgccccgaa gaacgttttc caatgatgag cacttttaaa 4680 gttctgctat gtggcgcggt attatcccgt attgacgccg ggcaagagca actcggtcgc 4740 cgcatacact attctcagaa tgacttggtt gagtactcac cagtcacaga aaagcatctt 4800 acggatggca tgacagtaag agaattatgc agtgctgcca taaccatgag tgataacact 4860 geggecaact tacttetgae aaegategga ggaeegaagg agetaaeege ttttttgeae 4920 aacatggggg atcatgtaac tcgccttgat cgttgggaac cggagctgaa tgaagccata 4980 ccaaacgacg agegtgacae caegatgeet gtageaatgg caacaaegtt gegeaaacta 5040 ttaactggcg aactacttac tctagcttcc cggcaacaat taatagactg gatggaggcg 5100 gataaagttg caggaccact tctgcgctcg gcccttccgg ctggctggtt tattgctgat 5160 aaatctggag ccggtgagcg tgggtctcgc ggtatcattg cagcactggg gccagatggt 5220 aagccctccc gtatcgtagt tatctacacg acggggagtc aggcaactat ggatgaacga 5280 aatagacaga tegetgagat aggtgeetea etgattaage attggtaaet gteagaceaa 5340 gtgaagatcc tttttgataa tctcatgacc aaaatccctt aacgtgagtt ttcgttccac 5460 tgagcgtcag accccgtaga aaagatcaaa ggatcttctt gagatccttt ttttctgcgc 5520 gtaatctgct gcttgcaaac aaaaaaacca ccgctaccag cggtggtttg tttgccggat 5580 caagagetae caactetttt teegaaggta aetggettea geagagegea gataceaaat 5640 actgtccttc tagtgtagcc gtagttaggc caccacttca agaactctgt agcaccgcct 5700 acataceteg etetgetaat eetgttaeea gtggetgetg eeagtggega taagtegtgt 5760 cttaccgggt tggactcaag acgatagtta ccggataagg cgcagcggtc gggctgaacg 5820 gggggttcgt gcacacagcc cagcttggag cgaacgacct acaccgaact gagataccta 5880 cagcgtgagc tatgagaaag cgccacgctt cccgaaggga gaaaggcgga caggtatccg 5940 gtaagcggca gggtcggaac aggagagcgc acgagggagc ttccaggggg aaacgcctgg 6000 tatctttata gtcctgtcgg gtttcgccac ctctgacttg agcgtcgatt tttgtgatgc 6060 tcgtcagggg ggcggagcct atggaaaaac gccagcaacg cggccttttt acggttcctg 6120 geettttget ggeettttge teacatgtte titeetgegt tateceetga tietgtggat 6180 aaccgtatta ccgcctttga gtgagctgat accgctcgcc gcagccgaac gaccgagcgc 6240 6269 agcgagtcag tgagcgagga agcggaaga

```
<210> 10
<211> 6299
<212> DNA
```

<220>

<223> Description of Artificial Sequence: udp and deoD cloned in pUC18 so to create a fusion between the two proteins bonded to each other via an aa linker

<400> 10 gegeceaata egeaaacege eteteceege gegttggeeg atteattaat geagetggea 60

<213> Artificial Sequence

cgacaggttt cccgactgga aagcgggcag tgagcgcaac gcaattaatg tgagttagct 120 cactcattag gcaccccagg ctttacactt tatgcttccg gctcgtatgt tgtgtggaat 180 tgtgagcgga taacaatttc acacaggaaa cagctatgac catgattacg aattcgagct 240 cggtaccatc catgtccaag tctgatgttt ttcatctcgg cctcactaaa aacgatttac 300 aaggggetac gettgecate gteeetggeg acceggateg tgtggaaaag ategeegege 360 tgatggataa gccggttaag ctggcatctc accgcgaatt cactacctgg cgtgcagagc 420 tggatggtaa acctgttatc gtctgctcta ccggtatcgg cggcccgtct acctctattg 480 ctgttgaaga gctggcacag ctgggcattc gcaccttcct gcgtatcggt acaacgggcg 540 ctattcagcc gcatattaat gtgggtgatg tcctggttac cacggcgtct gtccgtctgg 600 atggcgcgag cctgcacttc gcaccgctgg aattcccggc tgtcgctgat ttcgaatgta 660 cgactgcgct ggttgaagct gcgaaatcca ttggcgcgac aactcacgtt ggcgtgacag 720 cttcttctga taccttctac ccaggtcagg aacgttacga tacttactct ggtcgcgtag 780 ttcgtcactt taaaggttct atggaagagt ggcaggcgat gggcgtaatg aactatgaaa 840 tggaatctgc aaccetgctg accatgtgtg caagtcaggg cetgegtgee ggtatggtag 900 cgggtgttat cgttaaccgc acccagcaag agatcccgaa tgctgagacg atgaaacaaa 960 ccqaaaqcca tgcggtgaaa atcgtggtgg aagcggcgcg tcgtctgctg tccatgggcg 1020 gtggcagccc gggcattctg gccatggcta ccccacacat taatgcagaa atgggcgatt 1080 tcgctgacgt agttttgatg ccaggcgacc cgctgcgtgc gaagtatatt gctgaaactt 1140 teettgaaga tgeeegtgaa gtgaacaaeg ttegeggtat getgggette aceggtaett 1200 acaaaggccg caaaatttcc gtaatgggtc acggtatggg tatcccgtcc tgctccatct 1260 acaccaaaga actgatcacc gatttcggcg tgaagaaaat tatccgcgtg ggttcctgtg 1320 gcgcagttct gccgcacgta aaactgcgcg acgtcgttat cggtatgggt gcctgcaccg 1380 attocaaagt taaccgcatc cgttttaaag accatgactt tgccgctatc gctgacttcg 1440 acatggtgcg taacgcagta gatgcagcta aagcactggg tattgatgct cgcgtgggta 1500 acctgttctc cgctgacctg ttctactctc cggacggcga aatgttcgac gtgatggaaa 1560 aatacggcat teteggegtg gaaatggaag eggetggtat etaeggegte getgeagaat 1620 ttggcgcgaa agccctgacc atctgcaccg tatctgacca catccgcact cacgagcaga 1680 ccactgccgc tgagcgtcag actaccttca acgacatgat caaaatcgca ctggaatccg 1740 ttctgctggg cgataaagag taagtcgacc tgcaggcatg caagctttat gcttgtaaac 1800 cgttttgtga aaaaattttt aaaataaaaa aggggacctc tagggtcccc aattaattag 1860 taatataatc tattaaaggt cattcaaaag gtcatccacc ggatcagctt agtaaagccc 1920 togotagatt ttaatgogga tgttgogatt acttogocaa ctattgogat aacaagaaaa 1980 agecageett teatgatata teteecaatt tgtgtaggge ttattatgea egettaaaaa 2040 taataaaagc agacttgacc tgatagtttg gctgtgagca attatgtgct tagtgcatct 2100 aacgcttgag ttaagccgcg ccgcgaagcg gcgtcggctt gaacgaattg ttagacatta 2160 tttgccgact accttggtga tctcgccttt cacgtagtgg acaaattctt ccaactgatc 2220 tgcgcgccga gatgcgccgc gtgcggctgc tggagatggc ggacgcgatg gatatgttct 2280 gccaagggtt ggtttgcgca ttcacagttc tccgcaagaa ttgattggct ccaattcttg 2340 gagtggtgaa teegttageg aggtgeegee ggetteeatt eaggtegagg tggeeegget 2400 ccatgcaccg cgacgcaacg cggggaggca gacaaggtat agggcggcgc ctacaatcca 2460 tgccaacceg ttccatgtgc tcgccgaggc ggcataaatc gccgtgacga tcagcggtcc 2520 agtgategaa gttaggetgg taagageege gagegateet tgaagetgte eetgatggte 2580 gtcatctacc tgcctggaca gcatggcctg caacgcgggc atcccgatgc cgccggaagc 2640 gagaagaato ataatgggga aggocatooa gootogogto gogaacgoca goaagaogta 2700 gcccagcgcg teggeegeea tgeeggegat aatggeetge ttetegeega aaegtttggt 2760 ggcgggacca gtgacgaagg cttgagcgag ggcgtgcaag attccgaata ccgcaagcga 2820 caggoogate atogtogogo tocagogaaa goggtostog cogaaaatga cocagagogo 2880 tgccggcacc tgtcctacga gttgcatgat aaagaagaca gtcataagtg cggcgacgat 2940 agtcatgccc cgcgcccacc ggaaggagct gactgggttg aaggctctca agggcatcgg 3000 togacgotot coottatgog actootgoat taggaagcag cocagtagta ggttgaggoo 3060 gttgagcacc gccgccgcaa ggaatggtgc atgcaaggag atggcgccca acagtccccc 3120 ggccacgggg cctgccacca tacccacgcc gaaacaagcg ctcatgagcc cgaagtggcg 3180 agecegatet tecceategg tgatgtegge gatataggeg ecageaaceg cacetgtgge 3240 gccggtgatg ccggccacga tgcgtccggc gtagaggatc cacaggacgg gtgtggtcgc 3300 catgategeg tagtegatag tggetecaag tagegaageg ageaggaetg ggeggeggee 3360 aaagcggtcg gacagtgctc cgagaacggg tgcgcataga aattgcatca acgcatatag 3420 cgctagcagc acgccatagt gactggcgat gctgtcggaa tggacgatat cccgcaagag 3480 geceggeagt accggeataa ecaageetat geetacagea tecagggtga eggtgeegag 3540 gatgacgatg agegeattgt tagattteat acaeggtgee tgaetgegtt ageaatttaa 3600 ctgtgataaa ctaccgcatt aaagctcatg cggatcagtg agggtttgca actgcgggtc 3660 aaggatetgg atttegatea eggeaegate ategtgeggg agggeaaggg etecaaggat 3720 cgggccttga tgttacccga gagcttggca cccagcctgc gcgagcaggg gaattgatcc 3780 ggtggatgac cttttgaatg acctttaata gattatatta ctaattaatt ggggacccta 3840 gaggtcccct tttttatttt aaaaattttt tcacaaaacg gtttacaagc ataaagcttg 3900 gcactggccg tcgttttaca acgtcgtgac tgggaaaacc ctggcgttac ccaacttaat 3960 cgccttgcag cacateccec tttcgccage tggcgtaata gcgaagagge ccgcaccgat 4020 cgcccttccc aacagttgcg cagcctgaat ggcgaatggc gcctgatgcg gtattttctc 4080 cttacgcatc tgtgcggtat ttcacaccgc atatggtgca ctctcagtac aatctgctct 4140 gatgccgcat agttaagcca gccccgacac ccgccaacac ccgctgacgc gccctgacgg 4200 gettgtetge teceggeate egettacaga caagetgtga eegteteegg gagetgeatg 4260 tgtcagaggt tttcaccgtc atcaccgaaa cgcgcgagac gaaagggcct cgtgatacgc 4320 ctatttttat aggttaatgt catgataata atggtttctt agacgtcagg tggcactttt 4380 cggggaaatg tgcgcggaac ccctatttgt ttatttttct aaatacattc aaatatgtat 4440 ccgctcatga gacaataacc ctgataaatg cttcaataat attgaaaaag gaagagtatg 4500 agtattcaac atttccgtgt cgcccttatt cccttttttg cggcattttg ccttcctgtt 4560 tttgctcacc cagaaacgct ggtgaaagta aaagatgctg aagatcagtt gggtgcacga 4620 gtgggttaca tcgaactgga tctcaacagc ggtaagatcc ttgagagttt tcgccccgaa 4680 gaacgttttc caatgatgag cacttttaaa gttctgctat gtggcgcggt attatcccgt 4740 attgacgccg ggcaagagca actcggtcgc cgcatacact attctcagaa tgacttggtt 4800 gagtactcac cagtcacaga aaagcatctt acggatggca tgacagtaag agaattatgc 4860 agtgctgcca taaccatgag tgataacact gcggccaact tacttctgac aacgatcgga 4920 ggaccgaagg agctaaccgc ttttttgcac aacatggggg atcatgtaac tcgccttgat 4980 cgttgggaac cggagctgaa tgaagccata ccaaacgacg agcgtgacac cacgatgcct 5040 gtagcaatgg caacaacgtt gcgcaaacta ttaactggcg aactacttac tctagcttcc 5100 cggcaacaat taatagactg gatggaggcg gataaagttg caggaccact tetgegeteg 5160 gcccttccgg ctggctggtt tattgctgat aaatctggag ccggtgagcg tgggtctcgc 5220 ggtatcattg cagcactggg gccagatggt aagccctccc gtatcgtagt tatctacacg 5280 acggggagtc aggcaactat ggatgaacga aatagacaga tcgctgagat aggtgcctca 5340 ctgattaagc attggtaact gtcagaccaa gtttactcat atatacttta gattgattta 5400 aaacttcatt tttaatttaa aaggatctag gtgaagatcc tttttgataa tctcatgacc 5460 aaaatccctt aacgtgagtt ttcgttccac tgagcgtcag accccgtaga aaagatcaaa 5520 ggatettett gagateettt tittetgege gtaatetget gettgeaaac aaaaaaacca 5580 cogotaccag oggtggtttg tttgccggat caagagctac caactetttt tccgaaggta 5640 actggcttca gcagagcgca gataccaaat actgtccttc tagtgtagcc gtagttaggc 5700 caccacttca agaactetgt ageaeegeet acataceteg etetgetaat eetgttaeea 5760 giggetgetg ccagtggcga taagtegigt ettacegggt iggaeteaag acgatagita 5820

ccggataagg cgcagcggtc gggctgaacg gggggttcgt gcacacagcc cagcttggag 5880 cgaacgacct acaccgaact gagataccta cagcgtgagc tatgagaaag cgccacgctt 5940 cccgaaggga gaaaggcgga caggtatccg gtaagcggca gggtcggaac aggagagcgc 6000 acgagggagc ttccaggggg aaacgcctgg tatctttata gtcctgtcgg gtttcgccac 6060 ctctgacttg agcgtcgatt tttgtgatgc tcgtcagggg ggcggagcct atggaaaaac 6120 gccagcaacg cggccttttt acggttcctg gccttttgct ggccttttgc tcacatgttc 6180 tttcctgcgt tatcccctga ttctgtggat aaccgtatta ccgcctttga gtgagctgat 6240 accgctcgcc gcagccgaac gaccgagcgc agcgagcca tgagcgagaa agcggaaga 6299

<210> 11 <211> 2297 <212> DNA <213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: cloning vector derived from pUC18

<400> 11 gegeecaata egeaaacege eteteceege gegttggeeg atteattaat geagaatteg 60 ageteggtac eeggggatee tetagagteg acetgeagge atgeaagett atggtgeact 120 ctcagtacaa tctgctctga tgccgcatag ttaagccagc cccgacaccc gccaacaccc 180 getgaegege cetgaeggge ttgtetgete eeggeateeg ettacagaea agetgtgaee 240 gtctccggga gctgcatgtg tcagaggttt tcaccgtcat caccgaaacg cgcgagacga 300 aagggcctcg tgatacgcct attttatag gttaatgtca tgataataat ggtttcttag 360 acgtcaggtg gcacttttcg gggaaatgtg cgcggaaccc ctatttgttt atttttctaa 420 atacattcaa atatgtatcc gctcatgaga caataaccct gataaatgct tcaataatat 480 tgaaaaagga agagtatgag tattcaacat ttccgtgtcg cccttattcc cttttttgcg 540 gcattttgcc ttcctgtttt tgctcaccca gaaacgctgg tgaaagtaaa agatgctgaa 600 gatcagttgg gtgcacgagt gggttacatc gaactggatc tcaacagcgg taagatcctt 660 gagagttttc gccccgaaga acgttttcca atgatgagca cttttaaagt tctgctatgt 720 ggcgcggtat tatcccgtat tgacgccggg caagagcaac tcggtcgccg catacactat 780 totoagaatg acttggttga gtactcacca gtoacagaaa agcatottac ggatggcatg 840 acagtaagag aattatgcag tgctgccata accatgagtg ataacactgc ggccaactta 900 cttctgacaa cgatcggagg accgaaggag ctaaccgctt ttttgcacaa catgggggat 960 catgtaactc geettgateg ttgggaaceg gagetgaatg aageeatace aaacgaegag 1020 cgtgacacca cgatgcctgt agcaatggca acaacgttgc gcaaactatt aactggcgaa 1080 ctacttactc tagetteecg geaacaatta atagaetgga tggaggegga taaagttgca 1140 ggaccactte tgcgctcggc ccttccggct ggctggttta ttgctgataa atctggagcc 1200 ggtgagcgtg ggtctcgcgg tatcattgca gcactggggc cagatggtaa gccctcccgt 1260 atogtagtta totacacgae ggggagteag geaactatgg atgaacgaaa tagacagate 1320 gctgagatag gtgcctcact gattaagcat tggtaactgt cagaccaagt ttactcatat 1380 atactttaga ttgatttaaa acttcatttt taatttaaaa ggatctaggt gaagatcctt 1440 tttgataatc tcatgaccaa aatcccttaa cgtgagtttt cgttccactg agcgtcagac 1500 cccgtagaaa agatcaaagg atcttcttga gatccttttt ttctgcgcgt aatctgctgc $15\,\mathrm{\tilde{60}}$ ttgcaaacaa aaaaaccacc gctaccagcg gtggtttgtt tgccggatca agagctacca 1620 actettttte egaaggtaae tygetteage agagegeaga taccaaatae tyteetteta 1680 gtgtageegt agttaggeea ceaetteaag aactetgtag cacegeetae ataceteget 1740 ctgetaatee tgttaceagt ggetgetge agtggegata agtegtget tacegggttg 1800 gacteaagae gatagttace ggataaggeg cageggtegg getgaacggg gggttegtge 1860 acacageeca gettggageg aacgacetae acegaactga gatacetaea gegtgageta 1920 tgagaaaageg ceaegettee egaagggaga aaggeggaea ggtateeggt aageggeagg 1980 gteggaacag gagagegeae gagggagett eeagggggaa acgeetggta tetttatagt 2040 cetgtegggt teegeacet etgacettgag egtegattt tgtgatgete gteagggggg 2100 eggageetat ggaaaaacge eageaacgeg geettttae ggtteetgge ettttgetg 2160 cettttgete acatgttett teetgegtta teeeetgat etgtggataa eegtattaee 2220 geettttgagt gagetgatae egetegeege ageegaacga eegagegeag eggaaga 2297

<210> 12

<211> 3031

<212> DNA

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: udp and deoD cloned into pGM746 without upstream ptac promoter

<400> 12 gegeceaata egeaaacege eteteceege gegttggeeg atteattaat geagaatteg 60 agctcggtac ccggggatcc tagcaggagg gaattettee atggetacee cacacattaa 120 tgcagaaatg ggcgatttcg ctgacgtagt tttgatgcca ggcgacccgc tgcgtgcgaa 180 gtatattgct gaaactttcc ttgaagatgc ccgtgaagtg aacaacgttc gcggtatgct 240 gggcttcacc ggtacttaca aaggccgcaa aatttccgta atgggtcacg gtatgggtat 300 cccgtcctgc tccatctaca ccaaagaact gatcaccgat ttcggcgtga agaaaattat 360 ccgcgtgggt tcctgtggcg cagttctgcc gcacgtaaaa ctgcgcgacg tcgttatcgg 420 tatgggtgcc tgcaccgatt ccaaagttaa ccgcatccgt tttaaagacc atgactttgc 480 cgctatcgct gacttcgaca tggtgcgtaa cgcagtagat gcagctaaag cactgggtat 540 tgatgctcgc gtgggtaacc tgttctccgc tgacctgttc tactctccgg acggcgaaat 600 gttcgacgtg atggaaaaat acggcattct cggcgtggaa atggaagcgg ctggtatcta 660 eggegteget geagaatttg gegegaaage eetgaceate tgeacegtat etgaceacat 720 ccgcactcac gagcagacca ctgccgctga gcgtcagact accttcaacg acatgatcaa 780 aatcgcactg gaatccgttc tgctgggcga taaagagtaa gtcgacctgc aggcatgcaa 840 gettatggtg cacteteagt acaatetget etgatgeege atagttaage cageeeegae 900 accegecaac accegetgae gegeeetgae gggettgtet geteeeggea teegettaca 960 gacaagctgt gaccgtctcc gggagctgca tgtgtcagag gttttcaccg tcatcaccga 1020 aacgcgcgag acgaaagggc ctcgtgatac gcctattttt ataggttaat gtcatgataa 1080 taatggtttc ttagacgtca ggtggcactt ttcggggaaa tgtgcgcgga acccctattt 1140 gtttattttt ctaaatacat tcaaatatgt atccgctcat gagacaataa ccctgataaa 1200 tgcttcaata atattgaaaa aggaagagta tgagtattca acatttccgt gtcgccctta 1260 ttcccttttt tgcggcattt tgccttcctg tttttgctca cccagaaacg ctggtgaaag 1320 taaaagatgc tgaagatcag ttgggtgcac gagtgggtta catcgaactg gatctcaaca 1380 geggtaagat eettgagagt tttegeeeg aagaaegttt tecaatgatg ageaetttta 1440 aagttotgot atgtggegeg gtattatooc gtattgaege egggeaagag caacteggte 1500 geegeataca etatteteag aatgaettgg ttgagtaete accagteaca gaaaageate 1560 ttacggatgg catgacagta agagaattat gcagtgctgc cataaccatg agtgataaca 1620 ctgcggccaa cttacttctg acaacgatcg gaggaccgaa ggagctaacc gcttttttgc 1680 acaacatggg ggatcatgta actogoottg atogttggga accggagetg aatgaagcca 1740 taccaaacga cgagcgtgac accacgatgc ctgtagcaat ggcaacaacg ttgcgcaaac 1800 tattaactgg cgaactactt actctagctt cccggcaaca attaatagac tggatggagg 1860 cggataaagt tgcaggacca cttctgcgct cggcccttcc ggctggctgg tttattgctg 1920 ataaatctgg agccggtgag cgtgggtctc gcggtatcat tgcagcactg gggccagatg 1980 gtaagccctc ccgtatcgta gttatctaca cgacggggag tcaggcaact atggatgaac 2040 gaaatagaca gatcgctgag ataggtgcct cactgattaa gcattggtaa ctgtcagacc 2100 aagtttactc atatatactt tagattgatt taaaacttca tttttaattt aaaaggatct 2160 aggtgaagat cctttttgat aatctcatga ccaaaatccc ttaacgtgag ttttcgttcc 2220 actgagcgtc agaccccgta gaaaagatca aaggatcttc ttgagatcct ttttttctgc 2280 gcgtaatctg ctgcttgcaa acaaaaaac caccgctacc agcggtggtt tgtttgccgg 2340 atcaagagct accaactett ttteegaagg taactggett eageagageg eagataceaa 2400 atactgtcct tctagtgtag ccgtagttag gccaccactt caagaactct gtagcaccgc 2460 ctacatacet egetetgeta atectgttae eagtggetge tgecagtgge gataagtegt 2520 qtcttaccgg gttggactca agacgatagt taccggataa ggcgcagcgg tcgggctgaa 2580 cggggggttc gtgcacacag cccagcttgg agcgaacgac ctacaccgaa ctgagatacc 2640 tacagegtga getatgagaa agegeeaege tteeegaagg gagaaaggeg gacaggtate 2700 cggtaagcgg cagggtcgga acaggagagc gcacgaggga gcttccaggg ggaaacgcct 2760 ggtatettta tagteetgte gggtttegee acetetgaet tgagegtega tttttgtgat 2820 gctcgtcagg ggggcggagc ctatggaaaa acgccagcaa cgcggccttt ttacggttcc 2880 tggccttttg ctggcctttt gctcacatgt tctttcctgc gttatcccct gattctgtgg 2940 ataaccgtat taccgccttt gagtgagctg ataccgctcg ccgcagccga acgaccgage 3000 3031 gcagcgagtc agtgagcgag gaagcggaag a

<210> 13 <211> 3128 <212> DNA <213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: deoD cloned downstream ptac promoter

<400> 13
gegcccaata egcaaacege cteteccege gegttggeeg atteattaat geagaatteg 60
ageteegaca teataacggt tetggcaaat attetgaaat gagetgttga caattaatea 120
teggetegta taatgtgtgg aattgtgage ggataacaat tteacacagg aggatectag 180
caggagggaa ttettecatg getaceccae acattaatge agaaatggge gatttegetg 240
acgtagttt gatgccagge gaccegetge gtgegaagta tattgetgaa acttteettg 300
aagatgcceg tgaagtgaac aacgttegeg gtatgetggg etteaceggt acttacaaag 360
geogcaaaat tteegtaatg ggtaacggta tgggtateee gteetgetee atetacacca 420
aagaactgat caccgattte ggegtgaaga aaattateeg egtgggttee tgtggegeag 480
ttetgeegea egtaaaactg egegaegteg ttateegtat gggtgeetge accgatteea 540
aagttaaceg catcegtttt aaagaccatg acttageeg tateggetge tategetgae tteegacatgg 600

tgcgtaacgc agtagatgca gctaaagcac tgggtattga tgctcgcgtg ggtaacctgt 660 tetecgetga cetgttetae teteeggaeg gegaaatgtt egaegtgatg gaaaaataeg 720 gcattctcgg cgtggaaatg gaagcggctg gtatctacgg cgtcgctgca gaatttggcg 780 cqaaaqeeet gaccatetge acegtatetg accacateeg cacteaegag cagaceaetg 840 ccgctgagcg tcagactacc ttcaacqaca tgatcaaaat cgcactggaa tccgttctgc 900 tgggcgataa agagtaagto gacctgcagg catgcaagct tatggtgcac totcagtaca 960 atotgototg atgoogcata gttaagocag cocogacaco ogcoaacaco ogotgacgog 1020 ccctgacggg cttgtctgct cccggcatcc gcttacagac aagctgtgac cgtctccggg 1080 agetgeatgt gteagaggtt tteacegtea teacegaaae gegegagaeg aaagggeete 1140 gtgatacgcc tatttttata ggttaatgtc atgataataa tggtttctta gacgtcaggt 1200 ggcacttttc ggggaaatgt gcgcggaacc cctatttgtt tatttttcta aatacattca 1260 aatatgtatc cgctcatgag acaataaccc tgataaatgc ttcaataata ttgaaaaagg 1320 aagagtatga gtattcaaca tttccgtgtc gcccttattc ccttttttgc ggcattttgc 1380 cttcctgttt ttgctcaccc agaaacgctg gtgaaagtaa aagatgctga agatcagttg 1440 ggtgcacgag tgggttacat cgaactggat ctcaacagcg gtaagatcct tgagagtttt 1500 cgccccgaag aacgttttcc aatgatgagc acttttaaag ttctgctatg tggcgcggta 1560 ttatcccgta ttgacgccgg gcaagagcaa ctcggtcgcc gcatacacta ttctcagaat 1620 gacttggttg agtactcacc agtcacagaa aagcatctta cggatggcat gacagtaaga 1680 gaattatgca gtgctgccat aaccatgagt gataacactg cggccaactt acttctgaca 1740 acgatcggag gaccgaagga gctaaccgct tttttgcaca acatggggga tcatgtaact 1800 cgccttgatc gttgggaacc ggagctgaat gaagccatac caaacgacga gcgtgacacc 1860 acgatgcctg tagcaatggc aacaacgttg cgcaaactat taactggcga actacttact 1920 ctagcttccc ggcaacaatt aatagactgg atggaggcgg ataaagttgc aggaccactt 1980 ctgcgctcgg cccttccggc tggctggttt attgctgata aatctggagc cggtgagcgt 2040 gggtctcgcg gtatcattgc agcactgggg ccagatggta agccctcccg tatcgtagtt 2100 atctacacga cggggagtca ggcaactatg gatgaacgaa atagacagat cgctgagata 2160 ggtgcctcac tgattaagca ttggtaactg tcagaccaag tttactcata tatactttag 2220 attgatttaa aacttcattt ttaatttaaa aggatctagg tgaagatcct ttttgataat 2280 ctcatgacca aaatccctta acgtgagttt tcgttccact gagcgtcaga ccccgtagaa 2340 aagatcaaag gatcttcttg agatcctttt tttctgcgcg taatctgctg cttgcaaaca 2400 aaaaaaccac cgctaccagc ggtggtttgt ttgccggatc aagagctacc aactcttttt 2460 ccgaaggtaa ctggcttcag cagagcgcag ataccaaata ctgtccttct agtgtagccg 2520 tagttaggcc accacttcaa gaactctgta gcaccgccta catacctcgc tctgctaatc 2580 ctgttaccag tggctgctgc cagtggcgat aagtcgtgtc ttaccgggtt ggactcaaga 2640 cgatagttac cggataaggc gcagcggtcg ggctgaacgg ggggttcgtg cacacagccc 2700 agettggage gaacgaceta caccgaactg agatacetac agegtgaget atgagaaage 2760 gccacgette cegaagggag aaaggeggae aggtateegg taageggeag ggteggaaca 2820 ggagagcgca cgagggagct tccaggggga aacgcctggt atctttatag tcctgtcggg 2880 tttcgccacc tctgacttga gcgtcgattt ttgtgatgct cgtcaggggg gcggagccta 2940 tggaaaaacg ccagcaacgc ggccttttta cggttcctgg ccttttgctg gccttttgct 3000 cacatgttct ttcctgcgtt atcccctgat tctgtggata accgtattac cgcctttgag 3060 tgagctgata ccgctcgccg cagccgaacg accgagcgca gcgagtcagt gagcgaggaa 3120 3128 gcggaaga

<210> 14 <111> 3934 <212> DNA

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: udp and deoD cloned downstream ptac promoter

<400> 14 gcgcccaata cgcaaaccgc ctctccccgc gcgttggccg attcattaat gcagaattcg 60 agctccgaca tcataacggt tctggcaaat attctgaaat gagctgttga caattaatca 120 toggotogta taatgtgtgg aattgtgago ggataacaat ttcacacagg aggatoctag 180 caggagggaa ttcttccatg gctaccccac acattaatgc agaaatgggc gatttcgctg 240 acgtagtttt gatgccaggc gacccgctgc gtgcgaagta tattgctgaa actttccttg 300 aagatgcccg tgaagtgaac aacgttcgcg gtatgctggg cttcaccggt acttacaaag 360 geogeaaaat tteegtaatg ggteaeggta tgggtateee gteetgetee atetaeacea 420 aagaactgat caccgatttc ggcgtgaaga aaattatccg cgtgggttcc tgtggcgcag 480 ttctgccgca cgtaaaactg cgcgacgtcg ttatcggtat gggtgcctgc accgattcca 540 aagttaaccg catccgtttt aaagaccatg actttgccgc tatcgctgac ttcgacatgg 600 tgcgtaacgc agtagatgca gctaaagcac tgggtattga tgctcgcgtg ggtaacctgt 660 totocgotga cotgttotac totocggacg gogaaatgtt cgacgtgatg gaaaaatacg 720 gcattctcgg cgtggaaatg gaagcggctg gtatctacgg cgtcgctgca gaatttggcg 780 cqaaaqccct gaccatctgc accgtatctg accacatccg cactcacgag cagaccactg 840 ccgctgagcg tcagactacc ttcaacgaca tgatcaaaat cgcactggaa tccgttctgc 900 tgggcgataa agagtaagtc gacacaggaa acagctatga ccatgattac gaattcgagc 960 toggtaccat coatgtocaa gtotgatgtt tttcatctog gcotcactaa aaacgattta 1020 caaggggcta cgcttgccat cgtccctggc gacccggatc gtgtggaaaa gatcgccgcg 1080 ctgatggata agccggttaa gctggcatct caccgcgaat tcactacctg gcgtgcagag 1140 ctggatggta aacctgttat cgtctgctct accggtatcg gcggcccgtc tacctctatt 1200 gctgttgaag agctggcaca gctgggcatt cgcaccttcc tgcgtatcgg tacaacgggc 1260 gctattcagc cgcatattaa tgtgggtgat gtcctggtta ccacggcgtc tgtccgtctg 1320 gatggcgcga gcctgcactt cgcaccgctg gaattcccgg ctgtcgctga tttcgaatgt 1380 acgactgcgc tggttgaagc tgcgaaatcc attggcgcga caactcacgt tggcgtgaca 1440 gettettetg atacetteta eccaggicag gaaegitaeg atacttaete tggicgegia 1500 gttcgtcact ttaaaggttc tatggaagag tggcaggcga tgggcgtaat gaactatgaa 1560 atggaatetg caaccetget gaccatgtgt gcaagtcagg geetgegtge eggtatggta 1620 gegggtgtta tegttaaceg cacceageaa gagateeega atgetgagae gatgaaacaa 1680 accgaaagcc atgcggtgaa aatcgtggtg gaagcggcgc gtcgtctgct gtaattctct 1740 taagettatg gtgeactete agtacaatet getetgatge egeatagtta ageeageece 1800 gacaccegee aacacceget gacgegeet gacgggettg tetgeteeeg geateegett 1860 acagacaage tgtgaccgte teegggaget geatgtgtea gaggttttea eegteateae 1920 cgaaacgcgc gagacgaaag ggcctcgtga tacgcctatt tttataggtt aatgtcatga 1980 taataatggt ttcttagacg tcaggtggca cttttcgggg aaatgtgcgc ggaaccccta 2040 tttgtttatt tttctaaata cattcaaata tgtatccgct catgagacaa taaccctgat 2100 aaatgcttca ataatattga aaaaggaaga gtatgagtat tcaacatttc cgtgtcgccc 2160 ttattccctt ttttgcggca ttttgccttc ctgtttttgc tcacccagaa acgctggtga 2220 aagtaaaaga tgctgaagat cagttgggtg cacgagtggg ttacatcgaa ctggatctca 2280 acageggtaa gateettgag agtittegee eegaagaaeg titteeaatg atgageaett 2340 ttaaagttot gotatgtggo goggtattat ocogtattga ogoogggcaa gagcaactog 2400

gtogoogoat acactattot cagaatgact tggttgagta ctcaccagtc acagaaaagc 2460

atcttacgga tggcatgaca gtaagagaat tatgcagtgc tgccataacc atgagtgata 2520 acactgegge caacttaett etgacaacga teggaggaee gaaggageta aeegettttt 2580 tgcacaacat gggggatcat gtaactcgcc ttgatcgttg ggaaccggag ctgaatgaag 2640 ccataccaaa cgacgagcgt gacaccacga tgcctgtagc aatggcaaca acgttgcgca 2700 aactattaac tggcgaacta cttactctag cttcccggca acaattaata gactggatgg 2760 aggoggataa agttgcagga ccacttctgc gctcggccct tccggctggc tggtttattg 2820 ctgataaatc tggagccggt gagcgtgggt ctcgcggtat cattgcagca ctggggccag 2880 atggtaagcc ctcccgtatc gtagttatct acacgacggg gagtcaggca actatggatg 2940 aacgaaatag acagatcgct gagataggtg cctcactgat taagcattgg taactgtcag 3000 accaagttta ctcatatata ctttagattg atttaaaact tcatttttaa tttaaaagga 3060 tctaggtgaa gatccttttt gataatctca tgaccaaaat cccttaacgt gagttttcgt 3120 tocactgage gtcagacccc gtagaaaaga tcaaaggate ttettgagat cetttttte 3180 tgcgcgtaat ctgctgcttg caaacaaaaa aaccaccgct accagcggtg gtttgtttgc 3240 cggatcaaga gctaccaact ctttttccga aggtaactgg cttcagcaga gcgcagatac 3300 caaatactgt ccttctagtg tagccgtagt taggccacca cttcaagaac tctgtagcac 3360 cgcctacata cctcgctctg ctaatcctgt taccagtggc tgctgccagt ggcgataagt 3420 cgtgtcttac cgggttggac tcaagacgat agttaccgga taaggcgcag cggtcgggct 3480 gaacgggggg ttcgtgcaca cagcccagct tggagcgaac gacctacacc gaactgagat 3540 acctacageg tgagetatga gaaagegeea egetteeega agggagaaag geggacaggt 3600 atccggtaag cggcagggtc ggaacaggag agcgcacgag ggagcttcca gggggaaacg 3660 cctggtatct ttatagtcct gtcgggtttc gccacctctg acttgagcgt cgatttttgt 3720 gatgctcgtc aggggggcgg agcctatgga aaaacgccag caacgcggcc tttttacggt 3780 teetggeett ttgetggeet tttgeteaca tgttetttee tgegttatee eetgattetg 3840 tggataaccg tattaccgcc tttgagtgag ctgataccgc tcgccgcagc cgaacgaccg 3900 3934 agcgcagcga gtcagtgagc gaggaagcgg aaga

```
<210> 15
<211> 6046
<212> DNA
```

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: udp and deoD cloned downstream ptac promoter

<400> 15
gegcecaata egcaaacege eteteceege gegttggeeg atteattaat geagaatteg 60
ageteegaca teataacggt tetggeaaat attetgaaat gagetgttga caattaatea 120
teggetegta taatgtgtgg aattgtgage ggataacaat tteacacagg aggateetag 180
caggagggaa teetteeatg getaceeeae acattaatge agaaatggge gatttegetg 240
acgtagttt gatgeeagge gaceegetge gtgegaagta tattgetgaa acttteettg 300
aagatgeeeg tgaagtgaae aacgttegeg gtatgetggg etteaceggt acttacaaag 360
geegeaaaat teegtaatg ggteaeggta tgggtateee gteetgetee atetacaeae 420
aagaactgat eacegattee ggegtgaaga aaattateeg egtgggttee tgtgggegag 480
ttetgeegea egtaaaactg egegaegteg ttateggtat gggtgeetge acegatteea 540
aagttaaeeg eateegttt aaagaceatg actttgeege tategetgg ggtaaeetgt 660
tgegtaaege agtagatgea getaaageae tgggtattga tgetegetgg ggtaaeetgt 660

tetecgetga cetgttetae tetecggaeg gegaaatgtt egaegtgatg gaaaaataeg 720 gcattctcgg cgtggaaatg gaagcggctg gtatctacgg cgtcgctgca gaatttggcg 780 cgaaagccct gaccatctgc accgtatctg accacatccg cactcacgag cagaccactg 840 ccqctqaqcq tcaqactacc ttcaacqaca tgatcaaaat cgcactggaa tccqttctqc 900 tgggcgataa agagtaagtc gacacaggaa acagctatga ccatgattac gaattcgagc 960 toggtaccat coatgtocaa gtotgatgtt tttoatotog gootcactaa aaacgattta 1020 caaggggcta cgcttgccat cgtccctggc gacccggatc gtgtggaaaa gatcgccgcg 1080 ctgatggata agccggttaa gctggcatct caccgcgaat teactacetg gcgtgcagag 1140 ctggatggta aacctgttat cgtctgctct accggtatcg gcggcccgtc tacctctatt 1200 gctgttgaag agctggcaca gctgggcatt cgcaccttcc tgcgtatcgg tacaacgggc 1260 qctattcaqc cgcatattaa tgtgggtgat gtcctggtta ccacggcgtc tgtccgtctg 1320 gatggcgcga gcctgcactt cgcaccgctg gaattcccgg ctgtcgctga tttcgaatgt 1380 acgactgcgc tggttgaagc tgcgaaatcc attggcgcga caactcacgt tggcgtgaca 1440 gcttcttctg ataccttcta cccaggtcag gaacgttacg atacttactc tggtcgcgta 1500 gttcgtcact ttaaaggttc tatggaagag tggcaggcga tgggcgtaat gaactatgaa 1560 atggaatctg caaccctgct gaccatgtgt gcaagtcagg gcctgcgtgc cggtatggta 1620 gegggtgtta tegttaaceg cacceageaa gagateeega atgetgagae gatgaaacaa 1680 accgaaagcc atgcggtgaa aatcgtggtg gaagcggcgc gtcgtctgct gtaattctct 1740 taagctttat gcttgtaaac cgttttgtga aaaaattttt aaaataaaaa aggggacctc 1800 tagggtcccc aattaattag taatataatc tattaaaggt cattcaaaag gtcatccacc 1860 ggatcagett agtaaageee tegetagatt ttaatgegga tgttgegatt acttegeeaa 1920 ctattgcgat aacaagaaaa agccagcctt tcatgatata tctcccaatt tgtgtagggc 1980 ttattatgca cgcttaaaaa taataaaagc agacttgacc tgatagtttg gctgtgagca 2040 attatgtgct tagtgcatct aacgcttgag ttaagccgcg ccgcgaagcg gcgtcggctt 2100 gaacgaattg ttagacatta tttgccgact accttggtga tctcgccttt cacgtagtgg 2160 acaaattett ccaactgate tgcgcgccga gatgcgccgc gtgcggctgc tggagatggc 2220 ggacgcgatg gatatgttct gccaagggtt ggtttgcgca ttcacagttc tccgcaagaa 2280 ttgattggct ccaattcttg gagtggtgaa tccgttagcg aggtgccgcc ggcttccatt 2340 caggtegagg tggccegget ccatgcaceg cgacgcaacg eggggaggca gacaaggtat 2400 agggeggege ctacaateea tgecaaceeg ttecatgtge tegeegagge ggcataaate 2460 geogtgaega teageggtee agtgategaa gttaggetgg taagageege gagegateet 2520 tgaagctgtc cctgatggtc gtcatctacc tgcctggaca gcatggcctg caacgcgggc 2580 atcccgatgc cgccggaagc gagaagaatc ataatgggga aggccatcca gcctcgcgtc 2640 gegaacgeca geaagaegta geecagegeg teggeegeea tgeeggegat aatggeetge 2700 ttctcgccga aacgtttggt ggcgggacca gtgacgaagg cttgagcgag ggcgtgcaag 2760 attecgaata eegeaagega eaggeegate ategtegege teeagegaaa geggteeteg 2820 ccgaaaatga cccagagcgc tgccggcacc tgtcctacga gttgcatgat aaagaagaca 2880 gtcataagtg cggcgacgat agtcatgccc cgcgcccacc ggaaggagct gactgggttg 2940 aaggetetea agggeategg tegaegetet eeettatgeg acteetgeat taggaageag 3000 cccagtagta ggttgaggcc gttgagcacc gccgccgcaa ggaatggtgc atgcaaggag 3060 atggegeeca acagteece ggeeaegggg eetgeeaeca tacceaegee gaaacaageg 3120 ctcatgagec egaagtggeg agecegatet teceeategg tgatgtegge gatataggeg 3180 ccagcaaccg cacetgtggc geeggtgatg eeggecacga tgcgteegge gtagaggate 3240 cacaggacgg gtgtggtcgc catgatcgcg tagtcgatag tggctccaag tagcgaagcg 3300 agcaggactg ggcggcggcc aaagcggtcg gacagtgctc cgagaacggg tgcgcataga 3360 aattgcatca acgcatatag cgctagcagc acgccatagt gactggcgat gctgtcggaa 3420 tggacgatat coogcaagag goooggcagt acoggcataa ccaagcotat gootacagca 3480 tocagggtga eggtgeegag gatgaegatg agegeattgt tagattteat acaeggtgee 3540 tgactgcgtt agcaatt a ctgtgataaa ctaccgcatt aaagctcaig cggatcagtg 3600 agggtttgca actgcgggtc aaggatctgg atttcgatca cggcacgatc atcgtgcggg 3660 agggcaaggg ctccaaggat cgggccttga tgttacccga gagcttggca cccagcctgc 3720 qcgagcaggg gaattgatcc ggtggatgac cttttgaatg acctttaata gattatatta 3780 ctaattaatt ggggacccta gaggtcccct tttttatttt aaaaattttt tcacaaaacg 3840 gtttacaagc ataaagctta tggtgcactc tcagtacaat ctgctctgat gccgcatagt 3900 taagccagcc ccgacacccg ccaacacccg ctgacgcgcc ctgacgggct tgtctgctcc 3960 cggcatccgc ttacagacaa gctgtgaccg tctccgggag ctgcatgtgt cagaggtttt 4020 caccytcatc accyaaacyc ycyayacyaa agyycctcyt yatacyccta tttttatagy 4080 ttaatgtcat gataataatg gtttcttaga cgtcaggtgg cacttttcgg ggaaatgtgc 4140 gcggaacccc tatttgttta tttttctaaa tacattcaaa tatgtatccg ctcatgagac 4200 aataaccctg ataaatgctt caataatatt gaaaaaggaa gagtatgagt attcaacatt 4260 teegtgtege cettatteee ttttttgegg cattttgeet teetgttttt geteacceag 4320 aaacgctggt gaaagtaaaa gatgctgaag atcagttggg tgcacgagtg ggttacatcg 4380 aactggatct caacagcggt aagatccttg agagttttcg ccccgaagaa cgttttccaa 4440 tgatgagcac ttttaaagtt ctgctatgtg gcgcggtatt atcccgtatt gacgccgggc 4500 aagagcaact cggtcgccgc atacactatt ctcagaatga cttggttgag tactcaccag 4560 tcacagaaaa gcatcttacg gatggcatga cagtaagaga attatgcagt gctgccataa 4620 ccatgaqtqa taacactgcg gccaacttac ttctgacaac gatcggagga ccgaaggagc 4680 taaccgcttt tttgcacaac atgggggatc atgtaactcg ccttgatcgt tgggaaccgg 4740 agetgaatga ageeataeca aacgaegage gtgacaecae gatgeetgta geaatggeaa 4800 caacgttgcg caaactatta actggcgaac tacttactct agcttcccgg caacaattaa 4860 tagactggat ggaggcggat aaagttgcag gaccacttct gcgctcggcc cttccggctg 4920 gctggtttat tgctgataaa tctggagccg gtgagcgtgg gtctcgcggt atcattgcag 4980 cactggggcc agatggtaag ccctcccgta tcgtagttat ctacacgacg gggagtcagg 5040 caactatgga tgaacgaaat agacagatcg ctgagatagg tgcctcactg attaagcatt 5100 ggtaactgtc agaccaagtt tactcatata tactttagat tgatttaaaa cttcattttt 5160 aatttaaaag gatctaggtg aagatcettt ttgataatet catgaccaaa atccettaac 5220 gtgagttttc gttccactga gcgtcagacc ccgtagaaaa gatcaaagga tcttcttgag 5280 atcetttttt tetgegegta atetgetget tgeaaacaaa aaaaceaceg etaceagegg 5340 tggtttgttt geeggateaa gagetaecaa etetttttee gaaggtaaet ggetteagea 5400 gagogoagat accaaatact gtoottotag tgtagoogta gttaggooac cacttoaaga 5460 actotytage acceptaca tacetegete tectaateet ettaceagte getegeta 5520 gtggcgataa gtcgtgtctt accgggttgg actcaagacg atagttaccg gataaggcgc 5580 ageggteggg etgaaegggg ggttegtgea caeageecag ettggagega aegaeetaea 5640 ccgaactgag atacctacag cgtgagctat gagaaagcgc cacgcttccc gaagggagaa 5700 aggeggacag gtateeggta ageggeaggg teggaacagg agagegeaeg agggagette 5760 cagggggaaa cgcctggtat ctttatagtc ctgtcgggtt tcgccacctc tgacttgagc 5820 gtcgattttt gtgatgctcg tcaggggggc ggagcctatg gaaaaacgcc agcaacgcgg 5880 cettttacg gttcctggcc ttttgctggc cttttgctca catgttcttt cctgcgttat 5940 cocctgatto tgtggataac cgtattaccg cctttgagtg agctgatacc gctcgccgca 6000 6046 geegaacgae egagegeage gagteagtga gegaggaage ggaaga